NAS 1.9/4: 13/2

VOLUME 13/NUMBER 2
JANUARY 23, 1975
ACC. NOS. N75-10900 TO N75-11891

JUN 9 1975

STAR
AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

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Scientific and Technical Aerospace Reports, Volume 13, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1977.

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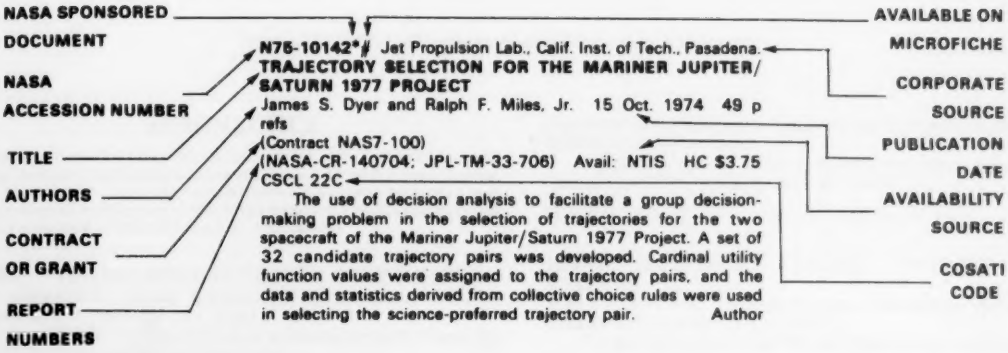
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N75-10142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRAJECTORY SELECTION FOR THE MARINER JUPITER/ SATURN 1977 PROJECT
James S. Dyer and Ralph F. Miles, Jr. 15 Oct. 1974 49 p refs
(Contract NAS7-100)
(NASA-CR-140704; JPL-TM-33-706) Avail: NTIS HC $3.75
CSCL 22C
The use of decision analysis to facilitate a group decision-making problem in the selection of trajectories for the two spacecraft of the Mariner Jupiter/Saturn 1977 Project. A set of 32 candidate trajectory pairs was developed. Cardinal utility function values were assigned to the trajectory pairs, and the data and statistics derived from collective choice rules were used in selecting the science-preferred trajectory pair. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power: Aircraft Stability and Control; and Research And Support Facilities (air). For Related Information See Also Astronautics.

1.0001, FLUIDIC APPROACH POWER COMPENSATOR
D. SCHAFFER, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (N00019-74-C-0162)

The objective of this program is to demonstrate the feasibility of a fluidic approach power compensator.

This shall be done through analysis of several fluidic approaches, trade-off studies and finally hardware implementation.

Supporting agency address information: Naval Air Systems Command 52022A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0002, NAVY VEHICLE DESIGN AND CONSTRUCTION - THERMAL STRESSES AND DEFORMATIONS IN AIRCRAFT AND MISSILES AT HYPERSONIC SPEEDS
N.J. HOFF, Stanford University, School of Engineering, *Palo Alto, California* 94305 (N00014-67-A-0112-0003)

This research comprises both theoretical and experimental investigations of structures, materials, and loadings encountered in the design of aircraft and missiles. Results of this work should permit more realistic design of such structures for severe flight environments and of components for compressors, nuclear power machinery, and jet engines.

The effect of creep on the behavior of joints connecting metallic structural elements will be undertaken both experimentally and theoretically. Joints with one and with more bolts will be studied in tension and creep tests will be made with the material of the structural elements to establish the proper creep law. Experimental results will be compared with the results of theoretical analyses.

Supporting agency address information: Office of Naval Research 439, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, CRASH-RESCUE AND FIRE FIGHTING
T.T. FU, U.S. Navy, Civil Engineering Lab., *Port Hueneme, California* 93041

To develop crash-rescue and fire fighting capabilities for V/STOL aircraft sites unique to the marcorps missions.

The crash-rescue and fire fighting requirements at the main bases, facilities, and forward sites will be investigated first. Subjects of importance are: (1) flying control: emergency landing procedure, (2) fire fighting; on and off runway capabilities, fire fighting agent, equipment, vehicle, techniques, and crew size, (3) rescue: rescue path, protective clothing, forcible entry tools, and (4) miscellaneous: ordnance cookoff, fire hazards, aircraft familiarization, accident report, etc. The results will be related to logistics to determine the types and sizes of equipment most suitable for each base. Survey will be made on crash-rescue and fire fighting operations for both on and off runway conditions. Available techniques and hardware will be used as much as possible to minimize the time and cost involved. Special emphasis will be placed on the portability and maneuverability requirements of the vehicles and equipments.

Supporting agency address information: Naval Air Systems Command 03P33, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, SUPERSONIC CASCADE ENTRANCE FLOW ANALYSIS
H.F. CREVELING, General Motors Corporation, *Indianapolis, Indiana* 46206 (N00019-73-C-0401)

To develop a rotational flow analysis for the entrance region of supersonic compressor cascades with subsonic axial velocities.

Analysis will include a detached shock model and allow for the subsequent rotational flow existing behind curved shocks. The analysis will be compared to the results of simple wave theory and selected cascade experimental data.

Supporting agency address information: Naval Air Systems Command 310, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0005, AADC POWER SUPPLY DEVELOPMENT FOR ADVANCED AVIONICS SYSTEMS
J.H. JENTZ, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218

The primary objective is to define, develop, and fabricate a family of reliable power supply modules which will meet the DC power requirements of the all application digital computer (AADC) and, also provide performance compatible with other Navy systems. The initial prototype to be developed is a 50 watt (5 VDC at 10 A) supply. Advanced power supply techniques will be incorporated to meet the reliability, power density, and power quality requirements for the AADC. The prototype modules will be implemented in incremental size multiples of the basic AADC module.

Advanced switching circuit techniques are being used in the AADC power supply modules. Since a design goal is small size, higher circuit package density will be accomplished by the use of hybrid circuits. Trade-offs in the over-all design will be based on (a) performance requirements, (b) reliability, (c) size, (d) output power density, (e) cost, and (f) efficiency. The AADC power supply modules are being designed to accept either 115 VRMS, single phase, 400 Hz aircraft or 115 VRMS, 30, 60 Hz shipboard input power. The three preferred output voltages are 5, 15, and 25 VDC of either polarity. The minimum power supplied by a single power supply module is 50 watts. The 5 and 15 volt supplies will also be provided in a 100 watt package. A large 5 VDC module will be developed in the power range of 200 to 500 watts as determined by the AADC power requirements.

Supporting agency address information: Naval Air Systems Command 52022B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0006, BLADE SURFACE BOUNDARY LAYER AND WAKE COMPUTATION MODEL STUDY
G.K. SEROVY, Iowa State University, Graduate School, *Ames, Iowa* 50010 (NSG 3033)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0007, HOLOGRAPHIC TECHNIQUES FOR AERODYNAMICS
T.F. ZIEN, U.S. Navy, Aerodynamics Department, *Silver Spring, Maryland* 20910

The overall objective of this research program is to make holographic interferometry a practical tool for quantitatively analyzing complex 3-dimensional flow fields such as those encountered in supersonic inlet systems.

To achieve the objective of making the technique a practical tool for wind-tunnel investigation of 3-dimensional flow fields, the task will include the following essential elements, - (a) to establish a satisfactory computer program for data reduction, (b) to develop, and subsequenlty refine, new techniques in experimental holography, particularly holographic interferometry. This effort is designed to support our objective of developing an accurate data reduction procedure, and, (c) to apply holographic interferometry to an actual wind-tunnel experiment of supersonic flows over a yawed cone. This represents a first attempt of using the technique for quantitative analyses of 3-dimensional flows.

Supporting agency address information: Naval Air Systems Command Air-310, Department of the Navy, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0008, HYDROFLUIDIC FLY-BY-TUBE FLIGHT CONTROL SYSTEM
R.A. EVANS, Honeywell Incorporated, *Minneapolis, Minnesota* 55408 (N00019-73-C-0415)

The objective of this program is to demonstrate the feasibility of a hydrofluidic fly-by-tube flight control system.

This shall be done by analyzing several fluidic backup concepts, choosing the most promising and predicting system performance.

Supporting agency address information: Naval Air Systems Command 52022A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0009, AN EXPLORATORY INVESTIGATION OF THE COOLING DRAG ASSOCIATED WITH GENERAL AVIATION PROPULSIVE SYSTEMS
E.J. CROSS, Mississippi St. University, Graduate School, *State College, Mississippi* 39762 (NSG 1083)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0010, AN EXPLORATORY FLIGHT INVESTIGATION OF LATERAL CONTROL NONLINEARITIES AND THEIR EFFECTS ON HANDLING QUALITIES
E. SECKEL, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (NSG 1078)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0011, AUTOMATIC FLIGHT PATH GUIDANCE TECHNIQUES
W. KEANE, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703

Analyze the full spectrum of Army aerial vehicle operations; apply modern flight control system concepts to satisfy critical aircraft stability and control and handling qualities requirements for safe and precise all weather flight performance.

Analytic and simulation evaluation of conceptual system designs. Major emphasis is placed on the use of man-in-the loop simulation techniques to evaluate the automatic control techniques and concepts investigated and developed.

Supporting agency address information: ECOM Avionics Lab, Ft. Monmouth, N.J. 07703.

SUPPORTED BY U.S. Dept. of Defense - Army

1.0012, LANDING FLIGHT RESEARCH FACILITY
J. SAGANOWICH, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703

To provide ground and airborne measurement and recording equipment for making quantitative performance evaluations of candidate tactical instrument landing systems and for obtaining engineering data (under actual flight conditions) needed for solving problems in tactical landing guidance systems, landing displays, visual aids and pilot factors.

Approach - provide techniques and equipment for determining a helicopter's position in space while it is simulating an instrument approach to a landing system. Accuracy and granularity must exceed expected capability of landing guidance systems to be evaluated. Determine airborne data which must be obtained to evaluate both landing system performance and pilot performance. Provide equipment for collecting, recording and reducing airbone data.

Supporting agency address information: ECOM Avionics Lab, AMSEL-VL- D, Ft. Monmouth, N.J. 07703.

SUPPORTED BY U.S. Dept. of Defense - Army

1.0013, REFURBISH, MODIFY AND RETEST MODEL HELICOPTER ROTOR SYSTEM
R. EWANS, Fairchild Space & Elect. Co., *Farmingdale, New York* 11735 (N00019-73-C-0448)

To obtain supplemental information to enable a more complete assessment to be made of the RVR (reverse velocity rotor) principle.

The potential of the reverse velocity concept will be further investigated by means of additional wind tunnel tests.

Supporting agency address information: Naval Air Systems Command 5301328, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0014, NAVY VEHICLE DESIGN AND CONSTRUCTION - INVESTIGATION OF SEPARATED FLOWS AT TRANSONIC SPEEDS
G. MILLER, New York University, School of Engineering, *New York, New York* 10453 (N00014-67-A-0467-0021)

Aerodynamic flow separation is an extremely complex phenomenon that limits the performance of naval aircraft and missiles throughout the speed range. Loss of control effectiveness at transonic speeds and reduced inlet performance at supersonic speeds are examples of adverse effects caused by shock induced separation. This research will concentrate on the development of an approximate numerical method for calculating the separated flow over an airfoil at transonic speeds.

The classical subdivision of the flow over a wing or body into a narrow viscous boundary layer imbedded in an external uncoupled inviscid flow ceases to be valid for separated flows. In the proposed investigation separation will be studied within the framework of equations of motion valid to the second order. In this way the effects of normal pressure gradients will be included. An inverse procedure will be used and the details of the recirculation region will be established. Initial emphasis will be on two-dimensional flows. Three-dimensional effects will be examined by an expansion technique with the assumption of small cross flow.

Supporting agency address information: Office of Naval Research 438, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0015, ESTIMATE PERFORMANCE & DYNAMIC RESPONSE CHARACTERISTICS OF AN ADVANCED TECHNOLOGY LIGHT TWIN AIRCRAFT & COMPARE WITH FLIGHT TEST RESULTS
F.O. SMETANA, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27600 (NSG 1077)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0016, ULTRA-FINE GRAIN ALLOYS FOR NAVAL AIRCRAFT STRUCTURES
R.C. MAY, Franklin Inst. of State of Pa., *Philadelphia, Pennsylvania* 19103 (N00019-72-C-0253)

Develop metal alloys with ultra-fine grain size and superior strength and ductility for advanced naval aircraft structures.

Research and development program directed toward the development of submicron grain size titanium. High strength, high ductility titanium will be produced by combining effects of interstitial content, cold work, texture control and grain refinement in an alpha and beta titanium alloy.

Supporting agency address information: Naval Air Systems Command 52031F, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0017, LAMINAR ANGULAR RATE SENSOR

B. YOUNG, General Electric Company, *Philadelphia, Pennsylvania* 19101 (N00019-74-C-0329)

The technical objectives of this program are to improve the environmental insensitivity of the laminar angular rate sensor and to improve null stability characteristics.

This will be accomplished through incorporation of specially designed end plates and utilization of better fabrication techniques.

Supporting agency address information: Naval Air Systems Command 52022A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0018, VISUAL LANDING AIDS FOR V/STOL (HARRIER)

M. KOLODNER, U.S. Navy, Air Engineering Center, *Philadelphia, Pennsylvania* 19112

Develop concepts and breadboard designs of VLA (visual landing aids) consisting of L and M (lighting and marking) and GSI (glide slope indicators) to assist the approach, hovering, landing/takeoff and recovery of V/STOL (Harrier) on SCS (sea control ship) and landbased airfields.

Establishment of firm fleet operational requirements. Study of applicability of existing landbased and non-aviation ships VLA principles to SCS. It includes an experimental L&M package, several tri- color GSI's stabilized bars and planes, and finally several position indicators. Search for alternate approaches for improved airfield systems, which may also be used on ships as well.

Supporting agency address information: Naval Air Systems Command 5374, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0019, V/STOL LAUNCH ASSIST

W. ZANE, U.S. Navy, Air Engineering Center, *Philadelphia, Pennsylvania* 19112

To determine the feasibility of providing launch assist to the AV- 8A, HARRIER, to enable it to be launched under maximum loading conditions from the limited flight decks of various ships, thereby increasing the aircraft's mission capability and flexibility.

Investigate the performance and structural data of the HARRIER to determine launch assist feasibility. Determine launching energy, launching force, stroke, and limit launching force required to launch the HARRIER for the full range of gross weights under various wind conditions. Investigate the size and configuration of the flight decks of various ships and correlate with the above data to determine the best way of providing launch assist to the HARRIER and those ships which could provide this capability.

Supporting agency address information: Naval Air Systems Command 53721, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0020, AIR CAPABLE SHIP AVIATION SYSTEMS OPERATIONAL ANALYSIS

J.L. CASWELL, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To identify and define the human factors problems of the aviation maintenance, supply and air operations departments of ships with aircraft capability. To develop such information as guidelines for the integration of human engineering, life and medical support, and personnel relationship efforts in the planning of adequate onboard aircraft maintenance. supply, and air operations facilities.

Review all studies and analyses of required aircraft/ship system missions and profiles as applied to human factors problems. Ascertain proposed weapon systems and air vehicles in terms of specific types of vessels. Study ship-aircraft interfaces and reliability and maintainability projections. Examine state of the art in automatic test equipment, containerized repair facilities, etc. To provide estimates of future human factors requirements for work spaces and crew accomodations with potential ship layouts. Determine maintenance/repair, supply, and air operations functions and the oceans environmental impact on system performance. Categorize and organize information obtained so as to determine relative significance of potential human factors problem areas.

Supporting agency address information: Naval Air Systems Command 03P34, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0021, MULTIPLEX INTERIOR COMMUNICATIONS

R. DESIPIO, U.S. Navy, Aero Electron Tech. Dept., *Warminster, Pennsylvania* 18974

Define, specify, and develop a GPMS to provide the basic information exchange media for aircraft interior wiring for both intra and interconnection of aircraft subsystems. This GPMS will be available for all future platforms including VFA/VSTOL, VPX, HSX, VAMX and RPV.

Survey existing dedicated airborne multiplex technology and systems. Then, based on these results, together with the use of advanced subsystems interconnection requirements, define and develop a system to service the total aircraft as an integrated whole. The total system interconnection will utilize the BIACC facility as the basic integrating platform.

Supporting agency address information: Naval Air Systems Command 360F, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0022, DEVELOPMENT OF LIGHTWEIGHT HYDRAULIC SYSTEM FOR ADVANCED VFX(V/STOL) AND VAX AIRCRAFT

J. DEVER, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop an advanced hydraulic system and components for advanced VFX(V/STOL) and VAX naval aircraft to reduce space requirements by 40 percent and system weight by 30 percent. This system will greatly alleviate space and weight deficiencies and allow conformance to the stringent requirements of advanced high-density thin-wing airframes. The application of high pressure principles will be utilized to realize these savings.

Conduct development of a LHS (lightweight hydraulic system) (8000 psi) hydraulic-actuator system and pump to establish dynamic system responses and pump performance at various operating parameters. Formulate a design specification for a solenoid valve and test under various high-pressure system conditions. Develop experimental high- pressure systems and perform endurance evaluations to analyze performance and design of critical components. Evaluate less flammable fluid MIL-H-83282, high-pressure leakage characteristics and seal designs. A major effort will be directed toward the application of the developmental concept to advanced design aircraft as the VFX(V/STOL) and VAX.

Supporting agency address information: Naval Air Systems Command 340C, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0023, DEVELOPMENT OF AIRCREW PROTECTIVE AND SURVIVAL SYSTEMS

J. HARDING, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To perform the necessary research and development, emphasizing new concepts and technologies, to translate CNO requirements for aircrew protective and survival systems into operationally satisfactory equipment that will protect aircrewmen against hazards which may arise in flight, during or after emergency escape/egress, and to allow for survival and rescue under all environmental conditions and operational hazards.

Studies, investigations and developments will be conducted to demonstrate the feasibility of new concepts and determine their suitability for fulfilling aircrew protective and survival system requirements. System prototype developments and evaluations will be conducted through in-house and contractual efforts. Current areas of investigation are detailed in Item 29D.

Supporting agency address information: Naval Air Systems Command 340B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0024, COD AIRCRAFT CARGO HANDLING SYSTEM DEVELOPMENT

R.L. HATE, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop a lightweight, rapid loading, low cost and safe cargo handling system for the next and ensuing generations of COD (carrier onboard delivery) type aircraft. Specific objectives include development of 'unitization' (pallets and/or containers) and attachment/restraint concepts, and cargo/passenger arrangements which will be compatible with the total carrier environment and with the required operational turnaround time and payload.

Investigations will be performed to determine and evaluate potential improvements to a cargo system resulting from a change in the application of the maximum specified acceleration forces from static to dynamic. The results will be applied to appropriate tradeoff studies of potential equipment/data, correlated with COD type aircraft parameters, and an optimum cargo handling design concept will be derived. Prototype hardware will be fabricated and tests will be conducted to verify and demonstrate system capability and potential operational improvement.

Supporting agency address information: Naval Air Systems Command 340C, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0025, ADVANCED CREW STATION MOCKUP DEVELOPMENT FOR VA/VF/VSTOL AIRCRAFT

L. HITCHCOCK, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To provide three-dimensional, full scale mock-ups incorporating current and proposed crew station technology. These mock-ups provide a consolidated, coherent method for development, evaluation, interrelation, coordination, and communication of the technology of the CSD.

Advanced concepts and technologies from the various crew systems disciplines will be incorporated into full scale cockpit mockups. Initially, two static mockups will be fabricated; one representing advanced seat design and one portraying the ICM (integrated crewstation module) approach. Additional mockup options representing other approaches and more advanced technological developments will be fabricated as part of the ongoing effort.

Supporting agency address information: Naval Air Development Center 01, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0026, LOW COST, SURVIVABLE COMPOSITE RPV FUSELAGE SECTION

S.L. HUANG, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

The in-house design and prototype fabrication of minimum cost, composite aerial vehicle structures. Principal program emphasis is on minimization of cost within the constraints of performance with primary consideration, from design inception of increased survivability and reduced weight.

Demonstration of program objectives will be attained through in- house analytical design synthesis, fabrication and laboratory proof testing of a fully-flight-qualified, minimum cost/minimum weight composite material version of the center section of the BQM-34E fuselage. As the program is concerned with structural innovation, the composite component will be aerodynamically identical to the existing structure and compatible with the present propulsion and stability/control system. It will incorporate integral crack arrestment features and should have a production cost less than that of the existing metal design. This effort will illustrate cost effective utilization of new material technology. Fabrication and testing will be completed 24 and 30 months, respectively, from program initiation.

Supporting agency address information: Naval Air Development Center 01, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0027, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION CONCEPTS FOR NAVAL AIRCRAFT

T.W. JANSEN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in high pressure hydraulics, onboard computers, electrical power generation and solid state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this task is to compare alternate concepts with traditional hydraulic systems to provide a basis for advising NAVAIRSYSCOM on best candidate systems for development.

Airframe manufacturers and flight control actuation specialists will be contracted to investigate innovative concepts for maneuvering aircraft. A development guide which emphasizes the importance of concepts which will increase aircraft availability, lower vulnerability, and minimize cost, will be prepared for solicitation of proposals. Selection of one or more concepts for detailed engineering analysis will be followed by hardware fabrication and flight demonstration. The current approach is to integrate the selected concept with high pressure hydraulic and control by digital computer technologies. Flight verification in a current aircraft is planned.

Supporting agency address information: Naval Air Systems Command 340D, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0028, DEVELOPMENT OF MILITARY FIXED SEATING SYSTEMS/SUBSYSTEMS FOR AIRCRAFT

W.G. LAW, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To perform research and development and testing of new aircraft fixed seating systems/subsystems for pilots, crewmembers, troops and passengers emphasizing the development of advanced concepts and technologies. Improving seating systems will increase mission effectiveness, comfort and survivability of aircraft occupants.

NAVAIRDEVCEN will develop and test prototype hardware and seating systems for future aircraft. Advanced concepts and components such as energy attenuation, cushioning, inertia reels, occupant restraint and pre-tensioning devices, armor and seat adjustment mechanisms will be improved or developed and integrated into seating systems for the aircraft crewmembers. Systems will be continuously improved and up-dated as new technology develops and new requirements are generated. Specifications will be prepared or modified as needed.

Supporting agency address information: Naval Air Systems Command 340B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0029, ADVANCED AERODYNAMIC CONCEPTS - R&D MANAGEMENT SUPPORT

C.J. MAZZA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

Provide planning and technical management services to naval air systems command for aerodynamic research and development contracts.

NAVAIRDEVCEN has assumed responsibility for a portion of the aerodynamics research and development contracting functions formerly managed solely by NAVAIRSYSCOM. The ad-

ministrative portion of this responsibility will include letting contracts, periodic reporting of progress and/or problems, and arranging report distribution. The technical management role will involve technical source recommendations (where applicable), scope definition, continuing technical guidance, and progress evaluation.

Supporting agency address information: Naval Air Systems Command 320D, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0030, SECANT BEARING EXPERIMENT
M. RADITZ, U.S. Navy, Aero Electron Tech. Dept., *Warminster, Pennsylvania* 18974

Concept formulation and development of bearing portion of the secant CAS (collision avoidance system) leading ultimately to an integrated CAS incorporating bearing measurements for the purpose of determining miss distance and horizontal avoidance maneuver. Investigate horizontal maneuvers and improvements to ANTC 117 threat logic. This work partially supports TSCR 34-25T and complies with the requirements set forth by the Interservice Working Group on collision avoidance. Bearing is not currently a part of the collision avoidance systems under investigation.

Analyze bearing measurement requirements. Analyze bearing measurement configuration. Determine hardware characteristics for bearing measurement and breadboard antenna. Perform laboratory and flight tests of feasibility hardware, the resultant miss distance calculations and horizontal maneuver commands. Investigate station keeping concept for which bearing is required. Investigate simplifications to ANTC 117 threat logic.

Supporting agency address information: Naval Air Systems Command 360G, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0031, HIGH TEMPERATURE STRUCTURAL AND AEROELASTIC RESPONSE
E.B. SCHWARTZ, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

Assess the influence of severe aerodynamic heating on the structural response and aeroelastic behavior of missile and air vehicle structures. Provide an analytical basis and systematic computerized methodology for the prediction of structural/aeroelastic response in a high speed thermal environment and utilize the procedures for the development of design practices required for efficient structural performance.

Investigate the adequacy of current state-of-the-art procedures for the prediction of aeroelastic response of realistic structures subjected to the severe thermal environment of high speed flight. Based upon this investigation, provide a computerized structural analysis procedure suitable for calculation of time dependent effective structural stiffness and natural vibration characteristics including the influence of the reduced elastic moduli and thermal stresses associated with nonuniform transient structural temperatures. Also, investigate unsteady aerodynamic force procedures which adequately account for significant thickness and boundary layer effects. Incorporate the structural and aerodynamic procedures into an appropriately developed flutter analysis methodology. Employ the analysis system in the development of guidance and rationale for the selection of the critical flight trajectories to be considered in the development of aeroelastic stability margins.

Supporting agency address information: Naval Air Systems Command 320B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0032, STRUCTURAL LOAD DESIGN CRITERIA FOR FUTURE NAVAL AIRCRAFT
M.E. SOENNICHSEN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

Develop improved flight and ground loads structural design requirements from operational usage data for incorporation in MIL-8860 Specifications, AR-56, and similar documents and assure inclusion of requirements peculiar to Navy and Marine Corps environment. Develop a technique utilizing piloted simulation to predict maneuver load spectra for future naval aircraft. Improved structural reliability and fatigue life for future naval aircraft will result.

Analyze and integrate flight and ground structural load history data compiled on operational aircraft and develop from these data improved structural load requirements reflecting the environment peculiar to Navy and Marine Corps aircraft. Develop a piloted simulation technique for predicting maneuver load spectra and verify the technique with available usage data. Obtain loads data by selectively conducting flight and landing surveys during fleet operations involving new aircraft and missions. Develop recording systems and equipment as required to conduct surveys.

Supporting agency address information: Naval Air Systems Command 320B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0033, INTEGRATED VEHICLE SYSTEMS TECHNOLOGIES (INVEST)
A. SPECTOR, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop selected vehicle technologies through advanced development which would bring many sybsystems to a point where they can be integrated into advanced naval aircraft designs. This is an air vehicle technology demonstrator effort, and is one of three technology demonstration programs collectively referred to as 'Development and Integrated Validation of Aircraft Systems (DIVAS)', which provides a mechanism for the orderly transition of new technology into future aircraft.

Select promising on-going vehicle technology R&D projects for integration as larger subsystems and incorporation in a flight test-bed aircraft to obtain valid experimental data. Results of these demonstrations would be applied as appropriate to advanced Navy aircraft or retrofit into existing production aircraft.

Supporting agency address information: Naval Air Systems Command 340, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0034, EXTERNAL FUEL TANKS FOR NAVAL AIRCRAFT AND ASSOCIATED COMPONENTS DEVELOPMENT
D.J. ST. JEAN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop a naval aircraft external fuel store that will significantly reduce the hazards and catastrophic effect when impacted by high velocity projectiles (a tumbled 50 cal bullet has been selected as the simulated threat) and subjected to fire (cook-off JP-4 fire 15 minutes). To design and evaluate new components and materials for use in future external fuel tanks.

Such concepts as (1) filament wound materials in lieu of the aluminum skin, (2) non-metallic materials formed in a sandwich construction or (3) combination of improved structural materials and sealing liners will be investigated for feasibility of use in tank construction. In addition to reducing the structural damage from high velocity projectiles, the new concepts must meet certain other parameters such as thermal resistance; aerodynamic considerations such as smoothness and flexibility; static electricity discharge; thermal expansion rates; fatigue and manhandling characteristics.

Supporting agency address information: Naval Air Systems Command 340, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0035, A GENERAL ALGORITHM USING FINITE ELEMENT METHODS FOR AERODYNAMIC CONFIGURATIONS IN INCOMPRESSIBLE FLOWS
G.L. GOGLIA, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1094)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0036, OPTIMAL WIND TUNNEL CONTROL
P.L. TOHENG, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1079)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

1.0037, NAVY VEHICLE DESIGN AND CONSTRUCTION - NAVY V/STOL AERODYNAMICS
J.L. LOTH, West Va. University, School of Engineering, *Morgantown, West Virginia* 26506 (N00014-68-A-0512)

Objective is to develop advanced technology in V/STOL aircraft aerodynamics, for typically Navy operating conditions and environment. This interdisciplinary program seeks to achieve higher lift capabilities, improved control and response, and increased performance for both STOL and VTOL aircraft in rescue, air ASW, amphibious air support and fleet support roles.

Analytically and experimentally investigate Navy V/STOL aircraft technology in areas such as aerodynamics, structural mechanics, aircraft stability and control, and propulsion as they pertain to advanced aircraft flight characteristics.

Supporting agency address information: Office of Naval Research 461, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, HEAVY PAYLOAD PROGRAM
E.T. BYRAM, U.S. Navy, Research Laboratory, *Washington,-District of Columbia* 20390

Development of large low cost carrier rockets such as ARIES, and availability of large space platforms, such as provided by NASA in the HEAO and Shuttle Programs, makes practical use of large instrumentations for space investigations. In the x-ray, y-ray region, evaluation of emission from the natural background and from man-made objects profits from the increased sensitivity provided by large detectors. Pointed payloads and large sensors are developed and used (1) to define the limits placed by nature on space military systems, (2) to augment technology for inspection of man-made objects in space.

Instrumentation requirements for the study of weak sources are defined. Large area x-ray sensors for space use, made practical by heavy payload capability, are developed. Studies of preselected sources are carried out using pointed ARIES rockets and pointed satellites to define natural background. Sensitivity of inspection capability is increased.

Supporting agency address information: Naval Research Laboratory (7000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

2.0002, MAGNETOSPHERIC AND INTERPLANETARY PLASMA FOR INTERNATIONAL SUN-EARTH EXPLORER MOTHER & DAUGHTER SPACECRAFT
L.A. FRANK, Univ. of Iowa, School of Arts, *Iowa City, Iowa* 52240 (NAS 5-20094)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

2.0003, THEORETICAL INVESTIGATION FOR ATMOSPHERIC EXPLORER C, D & E MISSIONS
J.C. WALKER, Cornell University, Graduate School, *Ithaca, New York* 14850 (NAS 5-20705)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

2.0004, STRUCTURAL RESPONSE OF REUSABLE SURFACE INSULATION PANELS OF SPACE SHUTTLE TO RANDOM PRESSURE FIELDS
R. VAICAITAS, Columbia University, School of Engineering, *New York, New York* 10027 (NSG 1059)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STUDY ON SPACE PROCESSING OF CRYSTALLINE MATERIALS
J.G. CASTLE, Univ. of Alabama, School of Science, *Huntsville, Alabama* 35814 (NAS 8-30774)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0002, DEVELOPMENT OF IRON BASE ALLOYS WITH SUPERIOR STRENGTH AND FRACTURE TOUGHNESS FOR USE AT CRYOGENIC TEMPERATURES
J.W. MORRIS, Univ. of California, School of Engineering, *Berkeley, California* 94720 (NGR 05-003-562)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0003, NAVAL VEHICLE TECHNOLOGY - FUNDAMENTALS OF ADHESION
W.D. BASCOM, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To improve the strength and performance of structural adhesives and fiber-reinforced composite materials by improving polymer adhesion to metal structures and reinforcing fibers. This research is of immediate importance in improving the strength of fiber resin composites and structural adhesives used in naval aircraft and ship construction.

The question of adherend or filler surfaces influencing the molecular structure of adjacent polymer is being examined experimentally. The experimental methods include the examination of fracture surfaces by high resolution microscopy and surface spectroscopy and a study of polymer reactions by differential scanning calorimetry (DSC).

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0004, ADSORPTION OF WATER VAPOR AND FINISHES ON FIBERS
V.R. DEITZ, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To increase the strength and reliability of fiber- reinforced composite materials, to determine the influence of fiber treatment and fiber surface composition on the strength of the fiber-resin bonds, and to determine the sensitivity of the bonds to water vapor.

High modulus, untreated carbon fibers from different sources are subjected to gas phase chemical treatments. The reacted fibers are examined by several physical and chemical procedures including scanning electron microscopy and electron diffraction in order to determine changes in fiber structure. Simple mechanical properties of the original and modified fibers are used to evaluate the effectiveness of each modification. Composite test specimens are prepared with modified fibers and examined by fracture mechanics.

Supporting agency address information: Naval Air Systems Command (52032A), Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0005, RESEARCH ON FACTORS DETERMINING THE PERFORMANCE OF NAVY HIGH STRENGTH STRUCTURAL METAL (ABBREV)
E.A. LANGE, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

New high-strength steels, titanium and aluminum alloys are required for use in aircraft, submarines and surface craft of advanced design. Successful fracture-safe design with these metals requires development and standardization of practical fracture toughness characterization test methods for quantitative definition of the interaction between metallurgical, mechanical, and structural aspects of fracture. The objective of this work is to develop quantitative laboratory methods for characterizing resistance to fracture and analysis procedures for translating the results to prediction of structural performance.

Investigations concerning effect of specimen and notch geometry and impact velocity will be conducted in support of ASTM standardization of the dynamic tear test. Develop improved analysis procedure for defining fracture states of DT temperature transition curves. J-integral fracture characterization procedures will be studied to establish applicability of the method for quantitative definition of elastic-plastic and plastic fracture.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0006, RESEARCH ON MICROSTRUCTURE - FRACTURE CHARACTERISTICS OF HIGH STRENGTH NAVAL METALS & ALLOYS (ABBREV)
E.A. METZBOWER, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Microscopic cracking mechanisms which cause slow crack growth in advanced military aircraft and ship components are identified by discussions with failure analysts close to the fleet, and studied in the laboratory in efforts to better understand and prevent these failures. Such studies contribute to a better understanding of the basic mechanisms of cracking, selection of better materials, and the designing of standard preventive tests.

The interdependent nature of the stress, microstructure, and environment on the microscopic scale, and how these change with time and crack growth are studied by observing the crack tip and fracture surfaces at high magnifications in electron microscopes, after the cracks have been grown under controlled laboratory conditions.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0007, ELECTRICAL POWER & ENVIRONMENTAL SUPPORT TECHNOLOGY - RESEARCH ON KINETICS IN GASES,LIQUIDS,SOLIDS, & THEIR INTERFACES
H.A. RESING, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To gain basic knowledge of atomic,ionic, and molecular kinetic behavior in materials of importance to the Navy. Emphasized at present are investigations of (a) molecular motions and (b) chemical analysis at gas-solid and liquid-solid interfaces in potential fuel cell components. Future studies will include ionic transport in solid electrolytes.

Pulsed nuclear magnetic resonance spectroscopy is used to measure nuclear magnetic resonance relaxation times and diffusion coefficients of adsorbed molecules, in both liquid and solid systems. Appropriate theories are generated to interpret these in terms of rates and types of molecular motions. Electron spectroscopy for chemical analysis (ESCA) and auger electron spectroscopy (AES) are used as analytic tools in investigating molecules absorbed on metals.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, MATERIAL SUPPORT TECHNOLOGY - RESEARCH ON THE PREPARATION AND PROPERTIES OF CERAMIC MATERIALS FOR USE IN NAVAL APPLIANCES
R.W. RICE, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Improve the reliability, predictability, and strength of ceramics to permit more efficient and wider application of unique ceramic properties in naval appplications (transducers, insulators, optical and radar windows, armor, etc.).

Determine the mechanisms of ceramic fracture and their dependence on material parameters (including processing, finishing, and microstructure) so that these key parameters can be changed in a controlled fashion to obtain optimum, reliable, and predictable mechanical properties.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0009, FUNDAMENTAL STUDY OF ELECTRODE REACTIONS; THEIR APPLICATION TO NAVAL BATTERIES & FUEL CELLS (ABBREV)
S. SCHULDINER, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To increase knowledge of catalytic and electrode processes so that more effective military batteries and fuel cells can be produced. Specific research areas are: electrode kinetics nd mechanisms; double- layer structure; sorption; diffusion; kinetics of electrochemically induced nucleation and crystallization.

To understand electrode processes, one must identify and know the activities of the chemical species in the reaction zone and know how these species interact under given conditions. IGH-purity systems studied by perturbation and relaxation methods make it possible to separate and determine electrical, chemical, and physical events. Automatic experimental control and data handling are being applied.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, MATERIAL SUPPORT TECHNOLOGY - FERROELECTRIC CERAMICS FOR SONAR TRANSDUCERS
P.L. SMITH, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Piezoelectric ceramics of improved uniformity, stability, and strength are needed by the Navy to provide more reliable sonar transducers. More information on both mechanical and electrical behavior of the ceramics under severe conditions is also needed. An immediate objective of this work is to investigate the properties of commercial sonar ceramics and to advise Navships on sonar ceramic problems. longer range objective is to develop improved materials.

Commercial ceramics are obtained either from production runs of transducer elements or as rings prepared according to MIL STD 1376. Preparation and fabrication of experimental compositions is carried out by Code 6136 of NRL.

Supporting agency address information: Naval Ship Systems Command (PMS 302-4), Washington, D.C. 20362.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0011, ENERGY CONVERSION TECHNOLOGY - ELECTRODE REACTIONS IN FUSED SALT ELECTROLYTES & THEIR USE AS MILITARY ELECTRICAL SOURCES
K.H. STERN, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To further the understanding of the properties and interactions between materials used, and potentially useful, for high-energy electrochemical devices such as batteries and fuel cells. Such studies should lead to the improvement of existing devices and to the development of new ones.

The thermal stability of solid and liquid ionic conductors (salts, glasses, ceramics) is studied by investigating their vaporization and thermal decomposition. Charge transfer processes in and between these materials are studied by electrochemical

techniques. Similarly, the behavior of metals and gases (potentially useful in electrochemical devices) in contact with ionic conductors is examined.

Supporting agency address information: Naval Research Laboratory (6000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, A STUDY OF THE REDOX PHOTO-CHEMISTRY OF A NUMBER OF IRON COMPLEXES
J.L. REED, Atlanta University, School of Arts, *Atlanta, Georgia* 30314 (NSG 8019)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0013, THE RESTORATION OF OBLITERATED SERIAL NUMBERS BY ULTRASONICALLY CAVITATED WATER
R.S. TREPTOW, Chicago State University, Graduate School, *Chicago, Illinois* 60621 (NSG 3030)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0014, WEAPONRY - CROSSED MOLECULAR BEAM STUDY OF THE REACTIONS OF OXYGEN ATOMS AND FREE RADICALS
Y.T. LEE, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637 (N00014-67-A-0285-0017)

The technical objective of this research is to advance our understanding of the kinetics of chemical reactions relative to combustion and missile plumes. These are of direct relationship to the Navy for advancement of missile and aircraft propulsion, chemical lasers, processes occurring during reentry, and atmospheric reaction of pollutants.

The crossed molecular beam technique will be used to investigate the reactions of oxygen atoms, both in the triplet p ground state and the metastable singlet d state. The velocity of the atoms generated by microwaves or photochemically, will be controlled by the molecular weight of carrier gas and expansion conditions in a nozzle beam. The beam of atoms will react with a crossed beam of selected free radical species including methyl, methylene, and hydroxyl. The products are to be measured by a rotating mass spectrometer detector which scans angular and velocity distribution. A dedicated mini-computer is to be used for on line data processing.

Supporting agency address information: Office of Naval Research 473, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0015, RESEARCH COMPOSITE MATERIALS
J.M. AUGL, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

To investigate and improve carbon fiber composites. This includes carbon fiber morphology, and investigation of the environmental stability of carbon fiber composites.

Environmental effects (such as humidity and temperature) on composites will be investigated. Mechanical and chemical changes will be determined as functions of time and temperature of environmental exposure. To isolate the effects of degradation due to resin fiber and/or interface these components will also be studied separately. In addition, certain aspects of fiber morphology will be investigated in order to correlate the type of fiber imperfections with the fabrication parameters of carbon fibers and their precursors.

Supporting agency address information: Naval Air Systems Command Engineering Division, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0016, ORDNANCE MATERIALS AT HIGH PRESSURE
N.L. COLEBURN, U.S. Navy, Explosions Research Department, *Silver Spring, Maryland* 20910

To study the effects of high pressures on the properties of solids including - dynamic changes in the mechanical, electrical, and magnetic properties produced by shock wave compression, production of new materials by shock compression, and shock wave propagation and compression at elevated temperatures. This information can be used to predict the response of structural materials and components in missiles and warheads to impulse loads.

Shock waves are used to compress metals, alloys, ceramics and semi- conductors. Dynamic effects on the compression, yield, electrical conductivity, and magnetic properties are measured during the shock transit (approx 1 microsec) by high-speed photography or special electronic probe methods. At present, conductivity, polarization effects in shocked semi-conductors, kinetic effects on the dynamic yields of alloys and semi-conductors, and sound velocities in materials under shock compression are being studied.

Supporting agency address information: Naval Ordnance Laboratory, Code 00, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0017, THERMODYNAMIC STUDIES OF HOT DENSE GASES (PROPELLANTS AND EXPLOSIVES)
G.L. HAMMOND, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

This study is directed toward obtaining data concerning the interatomic processes occuring in hot, compressed gases such as those in explosive detonations, nuclear rocket engines, and imploding underwater bubbles. These data contribute to calculation of forces, damage predictions, and the physical conditions in explosions and rocketry.

The experimental data required to achieve the above objective consists of accurate pressure, density, and temperature measurements in the NOL ballistic piston compressor over a pressure range of several thousand atmospheres and at temperatures up to 10,000 K. These data permit a mapping of the P, V, T surface for the gas species of interest at these hitherto unexplored physical conditions. The data are analyzed in terms of the intermolecular potential functions that describe the interaction between the colliding molecules.

Supporting agency address information: Naval Ordnance Laboratory, Code 00, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0018, DEVELOPMENT OF ANALYTICAL METHODS IN SUPPORT OF WETOX PEP DISPOSAL PROCESSES
M.E. HOUSER, U.S. Navy, Propellant Science Department, *Silver Spring, Maryland* 20910

To develop analytical methods for the pilot plant scale testing of wet-air oxidation disposal processes.

Wet air oxidation tests will be run (under propellant disposal facility funding) on selected propellants, propellant ingredients (such as HMX, RDX, TNT, AP, etc.,) on a pilot plant scale. Process effluents will be analyzed for use in optimization of operating parameters of the system. Wet chemical and instrumental methods will be used for complete characterization of the effluent ingredients.

Supporting agency address information: Naval Ordnance Systems Command ORD-0332, Washington 25, D.C. 20376.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0019, FUZED SALT ELECTROCHEMISTRY OF ANODE & CATHODE MATERIAL FOR PROJECTILE, ROCKET, BOMB, & MISSILE FUZE THERMAL BATTERIES
S.D. JAMES, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

Investigate the chemistry, stability and electrochemistry of high oxidation state metal complex ions as cathode meterials and of suitable anode materials in alkali halide melts for use in more energetic and longer discharge life thermal batteries for projectile, rocket, bomb and missile fuzes.

We are beginning an investigation of the electrode reactions of promising cathode materials in halide melts. The various oxidation states of elected metal ions will be studied by the technique of cyclic voltammetry. Pure Ag, Cu, Fe and V wires will be

anodized in LiCl-KCl melt to generate solutions of the lower oxidation states. These solutions will be subjected to triangular voltage sweeps at carbon test electrodes thus generating and examining the higher oxidation states.

Supporting agency address information: Naval Ordnance Laboratory, Code 00, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0020, DYNAMIC PROPERTIES OF SOLIDS USED IN EXPLOSIVE AND NUCLEAR WEAPONS

D.J. PASTINE, U.S. Navy, Explosions Research Department, *Silver Spring, Maryland* 20910

The objective of this work is to theoretically describe the behavior of materials undergoing strong shock compression. This includes mathematical formulation of theories on the thermalization and decay of shock waves in solids, theoretical description of magnetic and electrical phenomena occurring in shocked solids, and theoretically developed equations of state for solids. This information has a direct bearing on nuclear hardening and on the action of explosives and explosive ordnance.

Modern solid state physics is used to describe the effects of shocks in solids. The work is completely theoretical and mathematical. In the past considerable success has been attained in deriving theoretical equations of state for metals and molecular solids compressed at pressures ranging between a few bars and one megabar. Current work is being directed toward the establishment of a theory which will describe high pressure phase changes which occur in the transition metal series.

Supporting agency address information: Naval Ordnance Laboratory, Code 01, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0021, TRANSITION FROM DEFLAGRATION TO DETONATION

D. PRICE, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

To elucidate the mechanism of transition from deflagration to detonation in high explosives and propellants. To devise methods of increasing safety of explosives and propellants from the information gained. The information is needed to reduce the hazard involved in possible accidental detonation of rockets, such as Polaris, and in the use of explosive ordnance exposed to fires.

Continue development of electromagnetic methods for direct measurement of particle velocity in shocked materials with particular emphasis on the time profile. Apply to granular explosives, where possible. Continue studies of transient reactions leading to detonation. Use available hydrodynamic codes to supplement experimental work.

Supporting agency address information: Naval Ordnance Laboratory, Code 00, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0022, COMPRESSIBILITY OF POLYMERIC MATERIALS FOR REENTRY BODY HEAT SHIELDS AND UNDERWATER STRUCTURES

R.W. WARFIELD, U.S. Navy, Chemistry Research Department, *Silver Spring, Maryland* 20910

To determine the changes in various mechanical and thermodynamic properties of plastics and polymers with pressure and from these changes to modify or refine the theories of molecular structure and transitions in polymers and plastics. Such increased fundamental understanding will be used to improve materials for compressive applications, such as shock impulse loading of reentry heat shields or underwater structures.

To investigate the role that the various transitions play in determining the structure of solid polymers, it is planned to (1) locate these transitions by P-V-T measurements, (2) determine the pressure and temperature dependence of each transition and (3) to determine the relationships between the transitions. We have obtained some evidence that the magnitude of the pressure dependence indicates the approximate type of molecular motion involved. We would also expect to determine the elastic constants of the system at temperatures just below and just above each transition.

Supporting agency address information: Naval Ordnance Laboratory, Code 00, Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0023, LIQUID OXYGEN PROTECTIVE CLOTHING

S. LASH, U.S. Navy, Clothing & Textile Res. Unit, *Natick, Massachusetts* 01760

Develop an improved system of protective clothing and headgear to be worn by personnel during operational use of liquid oxygen and nitrogen.

Operational studies will be conducted and criteria, for material and design of clothing and headgear, established. Improved materials and item of clothing required will be developed for service testing. Technical requirements will be established.

Supporting agency address information: Naval Supply Systems Command 01A1A, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0024, ASBESTOS HANDLERS' COVERALLS

C.J. ZEMME, U.S. Navy, Clothing & Textile Res. Unit, *Natick, Massachusetts* 01760

Develop requirements for asbestos handlers' disposable-type coveralls.

Establish material and design requirements for disposable coveralls using a porous, flame-retardant, non-woven fabric, and size dimensions that will assure a good fit, to protect workers against the penetration of asbestos dust.

Supporting agency address information: Naval Supply Systems Command 01A1A, Washington, D.C. 20376.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0025, DEVELOPMENTAL STUDIES INVOLVING PROTECTIVE PERSONAL ITEMS AND SYSTEMS COMPONENTS

L.G. DERRICK, U.S. Navy, Medical Field Res. Lab., *Jacksonville, North Carolina* 28542

Develop techniques for assembling or laminating various types of textile materials (weaves, weights, felts, fibers, finishes), plastics, films, ceramics and metals for use in fabricating protective items. Obtain ballistic limit data and residual projectile velocities after penetration of ballistic material. Design protective items providing ballistic protection and body area coverage equal to current items but significantly lighter in weight. Design and fabricate experimental systems components that will enhance the capabilities of the military user. Develop flotation device(s) suitable for supporting an unconscious man.

Investigate the following parameters and their effects on ballistic performance: arrangement of different materials, bonding versus flexible panels, pressure and temperatures in forming composite ballistic panels, use of hard surface materials (ceramics and metals) with different types of back-up materials with areal densities of 15-24 oz/sq ft, ballistic testing at several angles of obliquity as well as normal incidence with different configuration (spheres, cubes, chisel nose, etc.) and weight (2-64 grain) fragment simulators. Measure the residual velocities of the missiles after penetration of the ballistic materials. Design, select materials and fabricate prototype experimental items of individual equipment that will more effectively meet current requirements for the item or its user.

Supporting agency address information: Naval Medical Field Research Lab., Camp Lejeune, N.C. 28542.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0026, A VIBRATIONAL STUDY OF STURUCTURES OF IONIC SYSTEMS

J.P. DEVLIN, Okla. St. Univ., Graduate School, *Stillwater, Oklahoma* 74075

Dr. Devlin's laboratory has been strongly influenced in the past three years by the discovery that, within a vacuum, several polyatomic salt melts volatilize smoothly, with minimal decomposition. This discovery has made possible spectroscopic studies of the simple pure ionic glasses as well as the matrix isolated

monomers and dimers such as M1 plus NO3 minus and (M1 plus NO3 minus)2. This ion pair spectra are valuable in displaying the limiting distortion of an anion by a particular cation which can then be used to calibrate the distortion for other anion environments such as the cation cage of the molten salts. The comparison of the ion-pair spectra for an inert (argon) and an associating matrix (H2O) is particularly informative regarding ion-pair solvation in aqueous solution. The water matrix data also facilitate identification of aqueous solution contact ion-pair spectral features. Studies for the latter purpose are to be emphasized in the immedate future. Research is continuing on the role of vibronic interactions in the vibrational spectra of radical anion salts. Our experimental study of the nature of co-deposits of alkali metals with covalent entities has two current objectives: elucidation of the spectrum of ammonia molecules in the solvated electron solvent cage in alkali metal ammonia glassy solutions, and the adaptation of resonance Raman spectroscopy to the detection of slight fluctuations in the stoichiometry of radical anion salts.

This work is a continuation of that currently supported by Foundation grants GP-242561 and GP-32341A1.

SUPPORTED BY U.S. Natl. Science Foundation

3.0027, SPECTROSCOPIC STUDY OF MILLISECOND LIFETIME PRODUCTS OF COMBUSTION

R. FIFER, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

To utilize techniques such as rapid scan infrared, Raman and excited state electronic spectroscopy to acquire data on transient species formed during combustion of nitrocellulose based propellants. To establish kinetic data, concentration versus time of these short-lived species especially during the 1.4 millisecond ballistic cycle of small arms. To identify and characterize the origins of the spectra of burning propellant compositions including spatial and temporal resolution.

Combustion reactions will be initiated in well characterized nitrocellulose compositions and the spectra of the combustion intermediates and products will be followed by rapid infrared, Raman, and electronic spectroscopic techniques including photometric and photographic detection. Reaction products will be identified with respect to space and time in the flame. Kinetics of formation and disappearance of products in different parts of the flame will be established where possible.

Supporting agency address information: ARMCOM Pitman Dunn Research Labs., Frankford AR, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

3.0028, THE ROLE OF CARTRIDGE CASE SURFACES IN PROPELLANT COMBUSTION

L. GRUSS, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

The reactivity or reflectivity of the cartridge case affects burning rate. It is very possible that the burning rate is affected by absorption or reflection of radiant energy produced during combustion or that the radicals and/or ions or other short-lived species interact with the metal surface. This study will investigate the role of metal and metal oxide coatings on the combustion of propellants.

The catalytic effects of brass, aluminum and steel used in cartridge cases will be studied. The usual process in measuring wall effects is to change the surface to volume ratio by packing or to coat the surface of the containing vessel. To accomplish the latter electrochemical or vacuum techniques will be used to deposit organic materials, metals and alloys, metal oxides, or anodic refractories such as silicates, aluminates, tungstates etc. On the casings and on the propellants. These coatings will have absorption or emission properties in different wave length regions. The absorptivities, emissivities and reflective properties of these coatings will be evaluated. A sufficient number of coated cartridge or coated propellant grains will then be tested to determine pressure-time characteristics. These results will be correlated with the reactivity structure and spectral properties of the coatings as they affect the burning rate. Where feasible similar coatings may be applied on the propellant grains. The fraction of heterogeneous to homogeneous reaction occurring in a fired round will be established.

Supporting agency address information: ARMCOM Pitman Dunn Research Labs., Frankford AR, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

3.0029, A SPECTROSCOPIC AND MOLECULAR ORBITAL STUDY OF COMBUSTION

L.E. HARRIS, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

To record the electronic spectra of the nitrocellulose prototypes, methylated nitrites and nitrates, and perform molecular orbital calculations of various degrees of complexity in pursuit of an understanding of the role of the excited states of nitrocellulose and its decomposition products in the fast gas phase reactions involved in combustion.

Electronic spectroscopy and quantum chemical calculations will be applied to nitrocellulose prototypes, alkyl nitrites and nitrates and their decomposition products (i.e. NO2, CO, NO, CO2, H2O) which are likely to be important as intermediates in combustion of nitrocellulose. The nitrocellulose prototypes and their decomposition products lend themselves to recently developed quantum chemical calculational techniques necessary for interpreting spectra. Both the semi-empirical and ab initio molecular orbital approaches will be employed. The two widely utilized semi-empirical methods to be used are- extended Huckel theory and the self-consistent field methods which neglect differential overlap to various degrees of approximation (the latter methods include CNDO, INDO and NNDO which, respectively, are complete, intermediate and non neglect of differential overlap). The ab initio calculations will employ the HF-SCF-LCAO method with Gaussian expansions of the basic functions. Extended configuration interaction will be applied to the molecular orbital results in an effort to obtain spectral information.

Supporting agency address information: ARMCOM Pitman Dunn Research Labs., Frankford AR, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

3.0030, FLAME ZONE TEMPERATURES BY HIGH RESOLUTION SPECTROSCOPY

J.A. LANNON, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

To develop spectroscopic techniques for measurement of temperature near the surface of burning nitrocellulose propellant and to attempt to determine temperature profile of gases in and immediately above the flame.

Infrared and ultraviolet spectroscopy will be coupled with a strand burner in order to study the vibrational-rotational of electronic- rotational spectra of the product gases from burning nitrocellulose as a function of temperature and pressure. For example, carbon monoxide appears during ignition or incipient combustion and the relative intensities of its rotational lines in the infrared or ultraviolet regions could provide an excellent measure of the rotational temperatures at lower pressures. Such studies have been performed on CO in the 2.5 micron region using an oxyacetylene torch. Plyler, et al, in these studies found a rotational temperature of about 2600 degrees K and a vibrational temperature of about 4000 degrees K. Our plans are to study the temperature of some of the gases produced during combustion (e.g., CO, CO2, or H2O) as a function of pressure. At lower pressures, we will use our high resolution 5 meter Jarrell Ash spectrometer.

Supporting agency address information: ARMCOM Pitman Dunn Research Labs., Frankford AR, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

3.0031, DIFFUSION OF PLASTICIZER IN NITROCELLULOSE AND NITROCELLULOSE/NITROGLYCERINE MATRICES

A.H. MITCHELL, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

The object of the proposed work is to measure transport phenomena and diffusion which underlie the penetration of various propellant combustion modifiers into the propellant matrix and to relate these processes to rates and mechanisms of burning.

Experimental and theoretical establishment of concentration gradients of additives in ball propellant will be related to burning characteristics and combustion models in the ballistic cycle. Amorphous materials such as the propellant consist of polymer segments whose thermal motion lead to diffusion. The processes of solution of plasticizer, deterrent, or booster into the polymer matrix and subsequent diffusion of the additive in the direction of minimized free energy can be mathematically treated. Following this the important result that combustion properties depend upon concentration gradients of these additives can be quantitatively established. Diffusion rates, diffusion coefficients, activation energies for flow depths of penetration, penetration mechanisms, and concentration gradients are results expected to be forthcoming from this approach. The proposed study can elucidate the plasticizer migration process, point out methods of minimizing migration and its effects, and provide reliable data for the realistic inclusion of deterrent effects in combustion models used in interior ballistics simulations.

Supporting agency address information: ARMCOM Pitman Dunn Research Labs., Frankford AR, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

3.0032, MECHANICAL POWER TRANSMISSION COMPONENTS FOR NAVAL AIRCRAFT

A. ANKENY, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

The objectives of this effort are to develop new self-lubricating bearing materials for use in helicopter rotor head control links which will increase life by 50 percent, improve reliability, and reduce maintenance through improvements in wear resistance.

Investigate wear resistance of three self-lubricating materials under simulated environmental conditions. Tests would include conditions of dust, water and various aircraft fluids with oscillatory motion under constant and cyclically varying load. Based on the results of these tests determine a 'preferred material' and provide samples for evaluation in a helicopter.

Supporting agency address information: Naval Air Systems Command 340C, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0033, RESEARCH ON CORROSION AND CORROSION RESISTANT STRUCTURAL AND PROPULSION SYSTEM MATERIALS

J.J. DELUCCIA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

Since the overall structural integrity of naval aircraft has a critical dependence on the elimination of catastrophic failures from corrosion and/or embrittlement, work in this unit involves research on the interactions of environment and stress on high strength alloys and composite materials as they relate to corrosion susceptibility and propensity to environmental cracking.

Research is being pursued on the mechanism and detection of microstructural corrosion and environmental cracking of high strength aluminum alloys by advanced state-of-the-art metallurgical and electrochemical techniques; on the corrosion and stress corrosion behavior of composite materials, both metal fiber/metal matrices and metal fiber/organic matrices; on the effects of cadmium on high strength alloys from a cadmium embrittlement and a hydrogen embrittlement standpoint.

Supporting agency address information: Naval Air Systems Command 320A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0034, RESEARCH ON ADVANCED ELECTROCHEMICAL AND METALLURGICAL TECHNIQUES IN THE STUDY OF ENVIRONMENTAL STRESS CRACKING OF NAVAL AIRCRAFT ALLOYS

J.J. DELUCCIA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To study stress corrosion and hydrogen embrittlement of high strength steels and titanium alloys using an integrated mechanistic approach. Determining the effect of hydrogen on the embrittlement of titanium is vital to the use of such material in high performance aircraft.

The diffusion of embrittling hydrogen in high strength aircraft alloys is being studied using the electrochemical permeation and metallurgical techniques in various chemical and mechanical environments. A capability to prepare titanium surfaces for subsequent electrochemical treatment has been established using thin film vacuum techniques. The nature of hydrogen's interaction with titanium alloys is thus being studied. The possibility of minimizing electrochemical hydrogen entry into metals by imposing physical constraints such as electromagnetic fields will be investigated.

Supporting agency address information: Naval Air Development Center 01, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0035, DEUTERATION OF FLUIDS FOR NAVAL AIRCRAFT

N. REBUCK, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

The goal of this program is to provide scientific guidelines for the next generation of aircraft fluids based on deuterium modified molecules. A more complete definition of deuteration processing will define directional information for new approaches to wide temperature range fluids combined with extreme pressure lubricant effects.

Our approach in this investigation involves the exchange of hydrogen atoms in a synthetic fluid with deuterium atoms via a liquid/gas phase transfer mechanism in the presence of a suitable catalyst. The properties of the resultant deuterium modified fluid were investigated in the fluid state as well as compounded into a grease formulation.

Supporting agency address information: Naval Air Development Center, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0036, RESEARCH ON HIGH STRENGTH/WEIGHT MATERIALS FOR NAVAL AIRCRAFT STRUCTURES

M. THOMAS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To identify, produce and characterize new high melting point (approx. 3000F) directionally solidified eutectic alloys which show promise for utilization in 2100-2500F engine environments.

Optical microscopy will be correlated with data from solidification experiments of candidate high temperature eutectic systems (approx. 3000F melting point) to select, produce and characterize a eutectic composite having superior strength/oxidation resistance in a 2100-2500F temperature environment.

Supporting agency address information: Naval Air Systems Command 320A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0037, MOLECULAR ABSORPTION PARAMETERS STUDY

UNKNOWN, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NAS 5-20672)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0038, HIGH TEMPERATURE KINETICS STUDIES OF COMBUSTION PROCESSES BY THE SHOCK TUBE TECHNIQUE

C.E. HUNTER, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1086)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0039, INVESTIGATION OF AEROSOL CHARACTERISTICS & THEIR MEASUREMENT

A. DEEPAK, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1090)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, OPTICAL GRANTING ANALYZER STUDIES

W. SHORT, Athens College, Undergraduate School, *Athens, Alabama* 35611 (NAS 8-30813)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0002, NAVY VEHICLE DESIGN AND CONSTRUCTION - NUMERICAL SOLUTIONS OF DIFFERENTIAL AND ALGEBRAIC EQUATIONS ARISING IN ENGINEERING MODELS

B.N. PARLETT, Univ. of California, School of Letters, *Berkeley, California* 94720 (N00014-69-A-0200-1017)

Many engineering problems in Navy vehicle design (e.g., vibration analysis and optimal structural design problems), the Navy environment (e.g., solving the partial differential equations of hydrodynamics), and surveillance (problems ranging from the processing of remote sensing data to the design of acoustic sensors) ultimately reduce to the numerical solution of differential and algebraic equations. These engineering problems often tax the best known computer algorithms. This project will develop more efficient algorithms with the capability to solve more complex problems than can presently be attacked. Also, techniques to give the engineer better bounds on numerical error will be developed.

Techniques will be developed for obtaining tight and computable error bounds for various algorithms. This will generally involve the development of very different approaches such as the use of symbolic manipulation for error analysis. The effect of computer operating systems and compilers on algorithm efficiency will be studied. Using the results of the above efforts, more efficient algorithms will be developed for various numerical problems.

Supporting agency address information: Office of Naval Research 432, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0003, COMMUNICATIONS - MILLIMETER MASERS

C.H. TOWNES, Univ. of California, School of Letters, *Berkeley, California* 94720 (N00014-69-A-0200-1003)

Research is directed toward inventing and improving sensitive maser receivers which can be used to detect signals in the millimeter wave region of the spectrum. Such receivers have wide applicability in naval detection and communications systems.

This study is directed to evolution of traveling-wave types of masers, with particular emphasis given to characteristics of broad-band dispersive structure elements in the maser cavity. Noise figures, tunability and sensitivity of masers operating in the 1 to 20 millimeter wavelength region are determined.

Supporting agency address information: Office of Naval Research 427, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, STUDY OF PATTERN SYNTHESIS OF CONFORMAL ANTENNA ARRAYS

W.H. KUMMER, Hughes Aircraft Company, *Culver City, California* 90230 (N00019-74-C-0127)

To develop techniques for the synthesis of antenna radiation patterns from conical surfaces.

Solutions of the fields radiated by the antenna elements on conical surfaces will be used to synthesize array patterns. The calculated patterns and the computed mutual coupling coefficients will be experimentally verified. This work will be applied to the design of future antennas conformal to the surface of aircraft and missiles.

Supporting agency address information: Naval Air Systems Command 310B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0005, DEVELOPMENT AND EVALUATION OF ADVANCE PARACHUTE CANOPY DESIGNS

J.D. BOONE, U.S. Navy, Aerospace Recovery Facil., *El Centro, California* 92243

To improve consistency of parachute canopy operation, simplify manufacturing procedures, improve quality control, reduce opening shock loads, reduce weight and bulk and improve operational envelope as a result of basic design capability. More specifically, a parachute canopy consisting of one to three pieces of fabric (as opposed to approximately 140 pieces in the present 28-ft flat canopy); reduction in operating forces by use of variable porosity and energy absorbing materials; peak force to be reduced from 8,000 to 6,500 lbs under present maximum load and velocity conditions; maintain, as a minimum, the present capabilities; reduce weight and bulk by 20 percent.

Circular woven fabric containing all necessary reinforcing tapes and ripstops as integrally woven parts; knit fabric wide enough to produce a canopy having from one to three pieces; reduction in opening force by use of canopy fabric having a force-variable porosity (high permeability under high load to reduce shock, low permeability under low load to reduce rate of descent); extending the parachute performance envelope by utilizing the above to give quick opening at low speeds and survivable force when opening at high speeds; reduction in weight and bulk will be achieved by eliminating seams and tapes.

Supporting agency address information: Naval Air Systems Command 340B, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0006, ATMOSPHERIC FLUID DYNAMICS

F.H. BUSSE, Univ. of California, School of Letters, *Los Angeles, California* 90024

The object of this research program is to elucidate basic mechanisms of atmospheric fluid dynamics with emphasis on the effects of thermal buoyancy and rotation. A major part of the proposal is concerned with the transition to turbulence of convection in a layer heated from below. The exemplary nature of convection as a model for the general problem of turbulence is emphasized. Two different experiments for the investigation of turbulent convection at intermediate and high Rayleigh numbers are proposed. In a third experiment it is planned to investigate a laboratory model for convection in a rotation spherical atmosphere with spherically symmetric temperature and gravity field. The theoretical part of the proposal is concerned with the problem of convection in the presence of a mean shear flow. The goal is to determine the onset of wavy disturbances which have been observed in laboratory experiments. The problem is relevant for the explanation of cloud streets.

SUPPORTED BY U.S. Natl. Science Foundation

4.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - DIMENSIONALITY REDUCTION IN STRUCTURAL SYNTHESIS

L.A. SCHMIT, Univ. of California, School of Engineering, *Los Angeles, California* 90024 (N00014-69-A-0200-4048)

Improved computer-based structural optimization capabilities offer the navy the prospect of more efficient operating systems in such areas as deeper diving submarines and high performance hydrofoil and air cushion surface ships all of which are weight-limited structures. In this effort research will be conducted on improving structural optimization techniques so that they eventually can be incorporated in a realistic manner into important Navy design problems.

Research efforts were recently begun to develop a procedure to optimize the distribution of the lowest natural frequencies of vibration of an elastic ring-stiffened cylindrical shell structure subjected to several different loading conditions, each with specified external pressure and axial loads. The structure is assumed constrained against excessive weight, several types of elastic buckling, and against yielding.

Supporting agency address information: Office of Naval Research 474, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0008, ELECTROHYDRODYNAMIC (EHD) RESEARCH
O. BIBLARZ, U.S. Navy, Postgraduate School, *Monterey, California* 93941

To extend the utility of EHD generators to operate with atmospheric gases. Auxiliary high voltage generators for aircraft comprise an application.

The definition and control of turbulence effects as they pertain to air flows and, in particular, as they affect breakdown.

Supporting agency address information: Naval Air Systems Command, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0009, HOLOGRAPHIC INTERFEROMETRY OF TRANSONIC CORNER FLOW
D.J. COLLINS, U.S. Navy, Postgraduate School, *Monterey, California* 93941

Holographic interferometry was applied to transonic corner flow in the NSRDC transonic wind tunnel.

It is believed that this was the first time that the density field has been obtained in corner flow using transparent models.

Supporting agency address information: Naval Air Systems Command, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0010, DIFFUSERS FOR SUPERSONIC LASERS
A.E. FUHS, U.S. Navy, Postgraduate School, *Monterey, California* 93941

Supersonic lasers, both gas dynamic and chemical, operate with subatmospheric pressure in the cavity. It is necessary to recover sufficient pressure to permit exhaust at atmospheric pressure. A fixed geometry is desired. Consequently there are starting problems. The air of the research is to develop a diffuser of short length, adequate pressure recovery and reliable starting characteristics.

Both analytical and experimental investigations will be conducted. The analytical approach will involve several techniques including (1) the Rudinger one-dimensional, unsteady, non-linear wave analysis, (2) linearized acoustic method for analogy with transmission line theory, and (3) unsteady two-dimensional method of characteristics. Experimentally, the NPS blow-down wind tunnel facility will be used. This facility has approximately 2000 cubic ft of dry air at 300 psig mass flow rates of 50 lbm/sec can be supported for 10 to 20 seconds depending on stagnation pressure. Initially small scale diffusers operating at mach 4 will be investigated. Starting events will be observed using shadowgraph, Schlieren and/or real time holographic interferometry. Wave propagation and establishment of the flow will be observed and compared with predictions.

Supporting agency address information: Naval Air Systems Command 320C, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0011, FLUERIC LOW FREQUENCY NOISE INVESTIGATION
T. SARPKAYA, U.S. Navy, Postgraduate School, *Monterey, California* 93941

To determine the sources of low frequency noise in fluidic amplifiers and to devise methods to eliminate them.

Test, analyze, and characterize the noise in basic flueric elements, identify the various disturbance conditions, and various coupling states. Correlate the experimental and theoretical results and determine the design changes necessary for improved signal-to-noise ratio.

Supporting agency address information: Naval Air Systems Command 52022A, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0012, ELECTRONIC RECOMBINATION GAS-DYNAMIC LASER STUDY
D. BERSHADER, Stanford University, Graduate School, *Palo Alto, California* 94305 (NSG 2035)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0013, OPTICAL EXCITATION BY HIGHLY MONOCHROMATIC TUNABLE DYE LASERS 9729-P
A.L. SCHAWLOW, Stanford University, School of Humanities, *Palo Alto, California* 94305 (DAHC04-71-C-0030)

To study technology of tunable lasers and their use for optical pumping experiments. This research is relevant to the use of coherent optical techniques for remote sensing of atomic constituents such as military vehicle emissions. Results should be useful for diverse applications as a laser tunable for target range finding and illumination.

Studies will include: light induced magnetism in materials; saturation spectroscopy of nonlinear lines in gases; selective reflection from metal vapors; optical pumping of inaccessible transitions; pumping of one dye by another, and spectroscopy of scattered light in liquids and solids.

Supporting agency address information: OCRD Research Office Durham, Durham, N.C. 27706.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0014, LOW COST AIRCRAFT NAVIGATION SYSTEM
W.F. BALL, U.S. Navy, Weapons Development Dept., *Ridgecrest, California* 93555

Investigate the application of low cost, strapdown inertial mechanizations to tactical aircraft navigators.

Navigation system mechanizations are analyzed, and the results input into the Advance Tactical Inertial Guidance System (ATIGS) experimental system (SYS X-0) development. These inputs will be used to insure that SYS X-0 is amenable to implementation as an augmented navigation system. A complete system will be evaluated through lab and flight tests in both the free inertial and optimally augmented modes. Government and industrial efforts in advanced navigation systems will be monitored to determine applicability to Navy attack aircraft missions.

Supporting agency address information: Naval Weapons Center (01), China Lake, California 93555.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0015, COMMUNICATIONS - IONOSPHERIC PROCESSES AFFECTING COMMUNICATIONS
K.R. WILSON, Univ. of California, Graduate School, *San Diego, California* 92038 (N00014-69-A-0200-6020)

The objective of this work is to determine quantitatively the photoionization processes important to naval communications via ionosphere reflection. Naval long-haul communications depend on the reflection of radio waves by the ionosphere which is created and maintained by solar irradiation. The solar irradiation causes photodissociation and photoionization of the molecules in the upper atmosphere. These processes must be understood so that radio reflection predictions can be made and so that methods of modifying the ionospheric reflection properties may be effective.

This work exploits a new experimental technique called translational spectroscopy, a technique whereby the energy partitioning among vibration rotation and translation of the fragements resulting from photolysis can be determined. Building on previous results of this method with ICN and I (2) the current effort will look for stimulated emission in the CN fragment and in the iodine atom. The photofragment spectra of HI and DI will be examined.

Supporting agency address information: Office of Naval Research 421, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0016, COMMUNICATIONS - SOLAR FLARES AND HIGH FREQUENCY COMMUNICATIONS
R.F. HOWARD, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (N00014-66-C-0239)

The objective is to examine the relation between solar structure and activity and their relation to disturbances in high frequency electromagnetic communications systems used in naval operations. Solar flares result in ionospheric disturbances, which interrupt electromagnetic communication systems. An understanding of solar flare activity and an ability to predict flares can be gained by studies of magnetic and velocity fields on the solar surface.

The work will consist of obtaining and reducing data from the solar magnetograph at the Mount Wilson Observatory, which will provide information concerning magnetic and velocity fields on the sun. The results will be analyzed for basic processes in the development and decay of solar active regions and in the solar activity cycle. Full-disc observations as well as fine-scan observations will be made. A flare patrol of active regions will continue.

Supporting agency address information: Office of Naval Research 421, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0017, COMMAND AND CONTROL - DEVELOPMENT OF A RECEIVER FOR ELECTROMAGNETIC WALSH WAVES
H.F. HARMUTH, Catholic University of America, Graduate School, *Washington, District of Columbia* 20017 (N00014-67-A-0377-0019)

While naval information processing and communication systems are employing digital computers more and more, the transmission and reception of non-sinusoidal or 'digital' electromagnetic waves has not been investigated. Present sinusoidal to digital interface equipment could be dispensed with if the data was transmitted in space digitally. While the generation and transmission of Walsh or 'digital' electromagnetic waves can be accomplished, the reception of such waves is a difficult problem. The object of this research is to develop a better theoretical solution to the problem and devise experimental receivers that detect Walsh waves.

The approach in detecting Walsh waves in the presence of noise will be to use a feedback circuit with a delay equal to the period. This will add all signals with this period arithmetically and cause their amplitude to increase proportionately with time. Signals with differenct periodic or nonperiodic signals will increase at a slower rate. In particular, noise will add statistically and its mean square deviation will increase proportionately to the square root of time.

Supporting agency address information: Office of Naval Research 430C, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0018, FLUIDIC AMPLIFICATION AND SENSING
J.M. KIRSHNER, U.S. Army, Harry Diamond Labs., *Washington, District of Columbia* 20310

To determine the factors affecting flueric amplifiers and to develop design theories- to examine methods of fluerically measuring temperature, velocity acceleration, angular velocity and acceleration, the presence or absence of objects, etc.

The analyses of the various types of amplifiers are being improved by taking into account some of the second order effects. Methods of using vortex concepts to obtain acceleration and concentration sensing are being investigated. Efforts are being made to obtain a high dynamic range broad band amplifier. The design analysis methods are being used to produce high input impedance and interface amplifiers. Methods of varying viscosity remotely are being investigated as a means of remote control of amplifiers.

Supporting agency address information: AMC Harry Diamond Labs, Washington, D.C. 20438.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0019, FLUID DYNAMICS OF FLUIDIC DEVICES
J.M. KIRSHNER, U.S. Army, Harry Diamond Labs., *Washington, District of Columbia* 20310

To examine the fundamental fluid dynamics pertinent to the operation of fluidic components so as to optimize their designs for particular uses. To examine ways in which various fluid phenomena may be used in order to obtain effects which can be put to practical use. To determine the effects on the flow in devices of various types of force fields, such as electric, magnetic, etc., so that fluid devices may be electrically or mechanically controlled and vice versa.

Flow fields and jet flows in fluid elements are being examined in order to provide a basis for a design theory of the devices and to indicate geometric changes which will improve the device characteristics.

Supporting agency address information: AMC Harry Diamond Labs, Washington, D.C. 20438.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0020, CHARGE COUPLED DEVICES
D. BARBE, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

The objective is to evaluate the effects of radiation on charged- coupled device structures and to determine design modifications necessary to produce devices with minimum sensitivity to a radiation environment.

Since no standardized charge-coupled device design has emerged, devices which are representative of the various designs being considered will be evaluated. These devices will be exposed to radiation and any changes in their electrical parameters will be noted. Failure mechanisms will be determined so that designs can be modified for increased resistance to radiation.

Supporting agency address information: Naval Research Laboratory, Office of Naval Research (5000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0021, C-BAND ANTENNAS FOR AIRCRAFT CARRIERS
J.P. BARRY, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

The objective of this effort is to determine design constraints and select those antenna techniques most suitable for providing a c-band antenna for the microwave landing system installation on board aircraft carriers.

All available materials bearing on the above objectives will be gathered and studied. The decision on the feasibility of techniques and approaches will be based on theoretical studies where possible. If necessary, experiments will be performed on prototype antennas using NRL's Chesapeake Bay site.

Supporting agency address information: Naval Electronic Systems Command, (NAVELEX 0341), Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0022, RADAR ENVIRONMENTAL MODELING
J.F. DIGGS, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

The ultimate objective of this effort is the development of computerized models of the radar target/clutter ratio as a function of the transmission parameters and target and background characteristics which are sufficiently realistic to allow predictions of radar performance to serve in lieu of more costly prototype development and flight testing.

The composite surface model of ocean backscatter previously developed at NRL will be used together with existing models of targets in order to determine the ensemble statistics required as input to a target/clutter return simulation. A statistical model of the signal return will be developed and utilized to evaluate the in clutter performance of subsystems and components.

Supporting agency address information: Naval Air Systems Command (AIR-310B), Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0023, TRANSIONOSPHERIC PROPAGATION
F.J. KELLY, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To investigate electromagnetic propagation in and through the ionosphere as applied to communications, navigation and timing systems.

Electromagnetic wave propagation through the ionosphere will be investigated theoretically and experimentally. Ray tracing and full wave calculation techniques will be used as appropriate. Experimental data will be correlated with theoretical results to improve the propagation analysis. The characteristics of the irregularities causing scintillation of transionospherically propagated waves will be determined by analyzing propagation data from beacon satellites and data from rocket or satellite plasma probes. The propagation effects of ionospheric disturbances will be studied. Waves reflected between the ionosphere and the ground can determine the outer extent of coverage of certain systems. These modes of propagation will be studied experimentally and theoretically also. The results will be applied to determine the feasibility or to improve the performance of communications systems.

Supporting agency address information: Naval Research Laboratory, Office of Naval Research (5000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0024, INVESTIGATION OF MILLIMETER WAVE INTEGRATED CIRCUITS FOR COMMUNICATION SYSTEMS AND RADARS

B.E. SPIELMAN, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

To investigate planar transmission media and techniques in the band from 10-90 GHz. Emphasis will be on configurations and techniques suitable for use in developing integrated circuit components operating into the millimeter wavelength region. Transmission media and techniques previously investigated have loss, radiative, and compactness characteristics not ideally suited to applications in communications, ECM, radar, and radio astronomy, at mm wavelengths.

Theoretical investigation, with experimental studies, of propagation in various media in the range from 10-90 GHz, including the development of analytical methods suitable for study of specialized electromagnetic phenomena. (e.g. Theoretical analysis of localized, as opposed to distributed, electromagnetic coupling between transmission lines.) Scaled models will be evaluated to demonstrate the feasibility of approaches that will lead to the development of system components.

Supporting agency address information: Naval Research Laboratory (5000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0025, FLUID-COOLED TWT

N. VANDERPLAATS, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Complete a design study for a high-power, wide-band, compact traveling-wave tube. The objectives are 300 kilowatts peak power at 5 percent duty and 40 percent minimum efficiency over a 0.6 GHz bandwidth centered near 1 GHz. Such a tube is desired for several wideband radar applications.

The tube will utilize a new fluid-cooled helix circuit approach developed at NRL, whereby the coolant flows inside and through a tubular helix and dielectric supports. This approach assures that the bandwidth and average power requirements will be met, and also provides a very effective frequency-selective loss method to stop backward-wave oscillations. The first phase is a design study at NRL to design the critical tube components, which include the helix assembly, RF windows, electron gun, collector, and beam focussing system. An operating device will be built to test the stability under simulated operating conditions.

Supporting agency address information: Naval Research Laboratory (5000), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0026, PERSONNEL TECHNOLOGY - PILOT PERFORMANCE AS A FUNCTION OF DYNAMIC MOVEMENT RELATIONSHIPS IN ATTITUDE-DIRECTOR FLIGHT DISPLAYS

S.N. ROSCOE, Univ. of Illinois, Inst. of Aviation, *Urbana, Illinois* 61801 (N00014-67-A-0305-0014)

A major problem in pilot performance has been control reversal errors due to ambiguous movement relationships in flight instruments. This research is concerned with investigating pilot performance in aircraft control tasks as a function of variation in relative movements of display symbols representing the aircraft, horizon and steering commands. Included are motion relationships used in conventional displays and others which involve the principle of display frequency separation, whereby rapidly changing information is presented by rapid aircraft symbol movement and more slowly changing information is presented by horizon symbol movement.

The approach includes a sequence of analytical studies, simulation and flight tests. A versatile CRT attitude-director display is being used to explore variations in movement relationships among symbols representing the aircraft, the horizon, and steering commands. Performance measures are being obtained using both highly experienced and novice pilots on tasks involving command flight path tracking, random heading tracking, disturbed attitude tracking and recovery from unusual attitudes. Data are being collected in a moving base simulator (GAT-2) and in flight (C-45H aircraft).

Supporting agency address information: Office of Naval Research 455, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0027, NAVY VEHICLE DESIGN AND CONSTRUCTION - MATHEMATICAL MODELING OF STRUCTURAL SYSTEMS

H.G. SCHAEFFER, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (N00014-67-A-0239-0028)

This study will continue to carry out research on the preparation of software for the mathematical modeling of complex Navy structural systems and will investigate use of a centralized, remote access, active structural software base. Other areas such as, establishment of software confidence levels, ease of acquisition and utilization of current Navy structures software packages, and investigation of future needs and modes of access, will also be examined.

Assessment of the optimum interaction between structural modeling analysis programs and the Navy user will be accomplished by evaluating the cost-effectiveness and user acceptance of various access modes (centralized, remote access, etc.) and degrees of interaction. Input data pre-processors and the interpretation of analytical results via post processor software packages, applied to existing structures software, will be examined. Input-output (I/O) tasks, lead items in user acceptance, will also be examined with particular emphasis on man- machine interactive modes. Adjunct to the proposed program will be a unique structural mechanics symposium effort involving several facets of the above approach.

Supporting agency address information: Office of Naval Research 474, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0028, HIGH ALTITUDE SENSORS (HASP) OF WIND AND TEMPERATURE

G. SLOAN, U.S. Navy, Ballistics Department, *Silver Spring, Maryland* 20910

Devise and demonstrate methods of determining the temperature, pressure, and density of the upper atmosphere by means of rocket-borne electronic instrumentation. Data are required for fleet support, such as missile flight path prediction and satellite calibration, as well as weather forecasting for aircraft and ship movement. Therefore, minimum data acquisition time is required.

Investigate temperature sensors such as beads and thin film thermistors and pressure switches by analytical means, laboratory tests, and flight tests. As a result of these investigations, devise and demonstrate a temperature sensor configuration of such well-defined thermodynamic and aerodynamic characteristics that, when combined with a precise pressure measurement, the tem-

perature and density of the atmosphere can be determined at altitudes from 75 kilometers.

Supporting agency address information: Naval Air Systems Command, Department of the Navy (AIR-370C), Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0029, DESIGN, DEVELOPMENT AND OPERATIONS OF THE HEAD MISSION B TELESCOPE EXPERIMENT
G.W. CLARK, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (NAS 8-30752)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0030, ENERGY CONVERSION - HEAT TRANSFER PROBLEMS IN ADVANCED GAS TURBINES FOR NAVAL APPLICATIONS
E.R. ECKERT, Univ. of Minnesota, School of Mechanical Engin., *Minneapolis, Minnesota* 55455 (N00014-68-A-0141-0001)

The objective of this program is to achieve the capability to predict the fluid flow and heat transfer which vitally affect gas turbine performance. Advanced gas turbines are needed particularly for propulsion of naval aircraft, for surface ships, and fixed installations; VTOL aircraft are of particular Navy interest. Particular attention needs to be given to such heat transfer processes as impingement and film cooling.

Professor Eckert and his group will conduct theoretical and experimental investigations in heat transfer and fluid dynamics pertinent to gas turbines. Because of the high gas temperatures required for high performance engines, attention will focus on various methods of cooling, such as impingement, film, transpiration, and convection.

Supporting agency address information: Office of Naval Research 473, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0031, NAVY VEHICLE DESIGN AND CONSTRUCTION - ULTIMATE STRENGTH OF STRUCTURAL ELEMENTS FOR ADVANCED DESIGN
P.G. HODGE, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (N00014-67-A-0113-0025)

More efficient structural design of naval vessels and weapons systems requires a better evaluation of the factor of safety against excessive deformation for a structure. For structures fabricated with ductile materials, the true factor of safety must be determined by means of plastic analysis. In particular, this task considers structural elements (plates, shells and torsion members) of direct application in naval systems.

Problems currently being studied include the finite deformation of rotationally symmetric plastic shells with emphasis on stability at the yield-point load, an elastic-plastic analysis of a heavy wheel rolling on a track, and a review of some aspects of the principle of virtual work. Under consideration is an attempt to develop a new model of plastic behavior which will reflect the statistical nature of material properties and be amenable to numerical solution.

Supporting agency address information: Office of Naval Research 439, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0032, SOUND PROPAGATION AND CORRELATION OF ELECTROMAGNETIC RADIATION
G. KASCHAK, U.S. Army, Electronic Warfare Laboratory, *Red Bank, New Jersey* 07703

To obtain experimental data on electromagnetic, seismic/acoustic, and bremsstrahlung radiation from rockets, nuclear explosions, and natural phenomena. In addition to the experimental data, appropriate theoretical analysis will be developed for each class of wave.

(1) The long range objective requires an extension of the data base established in the electromagnetic, VLF electrostatic, seismic/acoustic studies. Doppler sounders and magnetometers are operated continuously, providing data for a statistical study of propagating waves from man- made and natural events. The results will be applied to direction finding and intercept studies. (2) Coupling of both acoustic and shock waves from air to ground has been observed. These waves were generated by rockets. Further experiments are needed to explore the ionospheric and atmospheric disturbances.

Supporting agency address information: ECOM Electronic Warfare Lab, AMSEL-WL-S, Ft. Monmouth, N.J. 07703.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0033, COLD CATHODE DEVICES
S. LEVY, U.S. Army, Electronics Tech. & Dev. Lab., *Red Bank, New Jersey* 07703

The objective is to investigate lifetime limitations in cold cathode devices such as the Geiger Muller (G-M) counter used in Army radiac systems and Krytron used in Pockel cell, a switch device for laser range finders and designators. Lifetime improvements of a factor of 100 and 1000 are the goals for the G-M tube and Krytron respectively. Major barrier is bromine clean up in the G-M and cathode evaporation in the Krytron. Both tubes are urgently required for use in Army systems being developed under QMR 1239A(17).

The gas clean uo phenomena in the G-M tube will be studied to determine the cause for the loss of bromine. Quenching circuits will be studied to determine feasibility of using noble gas fills only. In the case of the Krytron, the cathode emissive material will be designed to resist sputtering. Low work function surfaces and cathode replenishment cycles will be investigated.

Supporting agency address information: ECOM Electronics Tech. Devices Lab, AMSEL-TL-BG, Ft. Monmouth, N.J. 07703.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0034, FIELD AND ANALYTICAL ENGINEERING SUPPORT OF THE SOUNDING ROCKET PROGRAM
UNKNOWN, New Mexico State University, Graduate School, *Las Cruces, New Mexico* 88001 (NAS 5-20681)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0035, VISCOUS FLOW SOLUTIONS BY A CUBIC SPLINE PROCEDURE
S.G. RUBIN, Polytechnic Inst. of New York, School of Engineering, *Brooklyn, New York* 11201 (NSG 1091)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0036, NAVY VEHICLE DESIGN AND CONSTRUCTION - EFFECTS OF SURFACE ROUGHNESS AND POROSITY ON THE PERFORMANCE OF GAS BEARINGS
H.G. ELROD, Columbia University, School of Engineering, *New York, New York* 10027 (N00014-67-A-0108-0021)

The low and constant friction, avoidance of contamination, elimination of lube oil systems, rigidity and other advantages of gas lubricated bearings have led to naval interest in their application to guidance system components, and data processing systems. This research, on the characteristics of ultra-thin gas films, should lead to substantial improvement in the design of memory pickup systems for data processing equipment and gyro air bearings.

Theoretical investigations will be carried out of laminar flow in ultra-thin gaps found in gas lubricated bearings, with surface roughness and porosity present, in order to establish the nature and order-of- magnitude of the attendant effects.

Supporting agency address information: Office of Naval Research 438, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0037, DESIGN, DEVELOPMENT AND OPERATION OF THE HEAD MISSION B X-RAY TELESCOPE EXPERIMENT
R. NOVICK, Columbia University, Graduate School, *New York, New York* 10027 (NAS 8-30753)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0038, COMMUNICATIONS - ATOMIC SCATTERING CROSS-SECTIONS FOR EVALUATING RADIO COMMUNICATIONS EFFECTS
L. SPRUCH, New York University, School of Arts, *New York, New York* 10003 (N00014-67-A-0467-0007)

The objective is to evaluate radio communications via the ionosphere used in Navy operational circuits. The ionization of atoms by electron impact and the scattering of electrons and ions by atoms and molecules are processes governing radio transmission, including black- out effects. The present work develops calculational techniques to estimate such ionization and scattering interactions for both the normal and disturbed ionosphere. The work also has applications to the estimation of ballistic missile signatures in a nuclear weapons environment and to the development of magnetohydrodynamic power sources.

Work involves estimation of cross-sections and transition probabilities for electron, atomic, ionic, and molecular systems. Upper and lower bounds on transition amplitudes are being obtained. The threshold behavior of break-up processes is being examined using variational principles. The effects of resonances in electron-hydrogen scattering and an effective range theory of the scattering of low-energy electrons by atoms are being investigated.

Supporting agency address information: Office of Naval Research 421, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0039, NAVY VEHICLE DESIGN AND CONSTRUCTION - INTERACTIVE GRAPHICS FOR USE IN STRUCTURAL OPTIMIZATION AND SIMULATION TECHNIQUES
K.D. WILLMERT, Clarkson College of Technology, Graduate School, *Potsdam, New York* 13676 (N00014-70-A-0311-0003)

The solution of nonlinear structural design problems using classical mathematical programming techniques become difficult if the number of variables exceed 50 to 100 elements. Combinations of the advances in the fields of numerical methods, finite element techniques, structural optimization, and remote computer communication devices provide a mechanism for effective research-design technology transfer and optimization. In this study research, will be continued on computer aided design and numerical analysis interactive computer methods, for optimum utilization of structural mechanics software applicable to Navy analysis and design needs.

Two approaches will be investigated for the optimization of structural problems involving several hundred to thousands of unknowns. The first approach utilizes a small number of iterations for the nonlinear optimization problem, coupled with interactive graphic displays, to efficiently readjust parameters and converge on global minimums. The second approach is concerned with utilization of a bilinear technique which is not directly applicable to the more general case but can be utilized in conjunction with interactive graphics as in the first method, for the general structure.

Supporting agency address information: Office of Naval Research 474, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0040, RECOGNITION OF ELECTROMAGNETIC SIGNATURES FOR TORNADO DETECTION
P.P. WANG, Duke University, School of Engineering, *Durham, North Carolina* 27706 (NSG 5020)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0041, SYNTHESIS AND OPTIMIZATION OF SPUR GEAR TOOTH PROFILE SHAPES FOR HIGH LOAD CAPACITY
R. KASUBA, Cleveland State University, School of Engineering, *Cleveland, Ohio* 44115 (NAS 3-18547)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0042, COMMUNICATIONS - MILLIMETER WAVE PROPAGATION RESEARCH AND RELATED ANTENNA AND RECEIVER DESIGN
J.P. HAGEN, Penn. State University, School of Science, *University Park, Pennsylvania* 16802 (N00014-71-C-0414)

The purpose of this work unit is to investigate millimeter wave propagation phenomena for application to telecommunications, and receiver system design.

Astronomical observations at x band and above will be carried out to obtain data on millimeter wave propagation through the entire earth's atmosphere.

Supporting agency address information: Office of Naval Research 427, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0043, BLADE END WALL FLOWS IN COMPRESSORS
B. LAKSHMINAFAYANA, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (NSG 3032)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0044, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT
C.R. ABRAMS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To initiate, evaluate and assist in the development of advanced AFCS (automatic flight control systems) for new Navy aircraft. The procedure is to utilize improved technologies in airborne digital computers, FBW (fly-by-wire) control systems, solid state sensors, data management systems and inflight identification techniques to produce a combat-survivable, fail-operational, failure-detectable and easily maintainable flight control system. Since new aircraft will require full-time stability augmentation, secondary objectives are improved redundancy and monitoring techniques to provide ultra-reliability.

Investigations will be made to determine the feasibility of digital flight control computers, solid state sensors, FBW interfaces, actuator interfaces, integrated control systems and reliability techniques. consequence of these investigations will be the formulation of new specifications to update specification MIL-C-18244A to reflect the requirements of highly augmented aircraft and provide adequate guidelines for future AFCS development.

Supporting agency address information: Naval Air Systems Command 340D, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0045, ADAPTIVE ARRAY ANTENNAS
E. COLEMAN, U.S. Navy, Aero Electron Tech. Dept., *Warminster, Pennsylvania* 18974

The objective of this program is to determine, implement and demonstrate those adaptive array techniques which can provide significant AJ (anti-jam) protection for future Navy communication systems. Adaptive antenna techniques can augment the required AJ/LPI (low probability of intercept) requirements of future CNI systems; decrease channel loss in sonobuoy communications due to coastal interference; and provide AJ to future satellite communication systems which may be susceptible to uplink jamming.

A critical component of any adaptive technique is the design of the antenna element weights. Various designs such as automatic gain control amplifiers, pin diode attenuators, and voltage controlled phase shifters will be evaluated. A three element array will be implemented with the selected weights and a power meter will be used as an array performance measure. The output data from the power meter will be fed to a computer and through software, various control algorithms will be employed to drive the element weights. In this way, two of the major adaptive techniques, null formation and power equalization can be applied to signal scenarios for evaluation. A sidelobe cancellor mode is also possible through software change. Once null steering is demonstrated, the array will be used to measure DOA (direction-of-arrival).

Supporting agency address information: Naval Air Development Center, Aero-Electron. Tech. Dept. 01, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0046, DEVELOPMENT OF HIGH VOLTAGE DIRECT CURRENT GENERATOR SYSTEM FOR NAVAL AIRCRAFT
R.H. IRELAND, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop a high voltage direct current electric power system for naval aircraft. Advanced machine design and semiconductor technology will be employed to develop a total power system which will increase system efficiency by at least 10 percent, reduce weight, double the reliability and improve electric power quality at the utilization equipment terminals. The development of the complete system concept is being continued for advanced aircraft such as the F-14, AV-8, XFV-12, S- 3 a d vp aircraft compatibility.

A total system development approach is planned. A brushless DC generator and solid state regulator control unit will provide raw power, control and protection. A low inductance transmission line will facilitate solid state switching and help eliminate spurious spikes, transients and EMI. Power conditioners, both DC to DC and DC to AC, will provide isolation and specific power characteristics.

Supporting agency address information: Naval Air Systems Command 340D, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0047, DEVELOPMENT OF IN-FLIGHT ESCAPE SYSTEM FOR MILITARY AIRCRAFT
W.G. LAW, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To develop advanced concepts and techniques and to determine their feasibility for escape systems and related components. These developments will increase the escape envelope, effectiveness and safety for aircrewmen during routine, combat and emergency flight conditions in military aircraft.

Investigative studies will be conducted, subsystems and component designs will be prototyped, hardware will be fabricated and tests conducted to determine feasibility of new concepts and technologies and their suitability for fulfilling the escape system requirements of present and planned naval aircraft.

Supporting agency address information: Naval Air Systems Command 340B, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0048, DEVELOPMENT OF AN IN-FLIGHT MAINTENANCE MONITORING SYSTEM (MMS) FOR NAVY ROTARY WING AIRCRAFT
D. LISS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To develop a maintenance monitoring system (MMS) for in-flight diagnostics and maintenance monitoring of aircraft systems and to flight demonstrate the MMS in SH-3 helicopters.

To contract with teledyne controls for the development of their flight data and acquisition system as an in-flight diagnostic and maintenance monitoring system for rotary wing aircraft. Contractor to adapt and install the equipment in Navy SH-3 helicopters and assist in equipment calibration and checkout and provide engineering and technical support during flight tests. Navy maintenance and flight personnel to be trained in operational use of the equipment. Navy is to perform normal flight operations with SH-3DS. Informal monthly progress reports and a final report to be prepared by the contractor.

Supporting agency address information: Naval Air Systems Command 53371G, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0049, VERY LARGE SCALE INTEGRATION FOR THE ALL APPLICATIONS DIGITAL COMPUTER
C.F. MATTES, U.S. Navy, Aero Electron Tech. Dept., *Warminster, Pennsylvania* 18974

The objective of this work unit is to evaluate the cost and reliability improvements that can be achieved by applying VLSI (very large scale integration) fabrication techniques to the AADC (all applications digital computer).

Hardware design and fabrication of portions of the AADC DPE (data processing element) will be accomplished utilizing advanced VLSI techniques. This work will be done under industry contracts established by NAVAIRDEVCEN. Hardware evaluation will be performed in-house in conjunction with the AADC ADM (advanced development models) evaluation set-up.

Supporting agency address information: Naval Air Systems Command 360G, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0050, AIRCRAFT NAVIGATION REFERENCE UNITS
F. SNYDER, U.S. Navy, Aero Electron Tech. Dept., *Warminster, Pennsylvania* 18974

Investigating feasibility of making state-of-the-art advancements in navigation reference units and develop experimental models providing navigation and flight reference functions for future naval aircraft weapons systems. Concepts and experimental units applicable to a wide range of airborne vehicle applications such as sea control ship, antisub warfare, search and rescue, attack, fighter and reconnaissance are to be developed. Work under this airtask is being coordinated with that under 'Aircraft Navigation Systems Technology' airtask.

Advanced navigation and flight reference concepts and experimental models using conventional and unconventional gyroscopic, geomag, and geodetic technology are developed. Developments accomplished by investigating new concepts, analyzing resulting implementations, assembling experimental models, and demonstrating feasibility with experimental models. After demonstrating feasibility of promising concepts and mechanics, system functional operation is analyzed with respect to actual performance and dynamic optimization is implemented. Improved performance is verified in the aircraft environment.

Supporting agency address information: Naval Air Systems Command 360G, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0051, FLUERICS/FLUIDICS FOR NAVY AIRCRAFT AND MISSILE SYSTEMS
H.B. WELK, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974

To provide technical support for NAVAIRSYSCOM in the selection, development of technical requirements, and monitoring of fluidic research and development programs. To provide laboratory test facilities and technical capability to support this work.

This effort involves scheduling, technical monitoring and laboratory/flight evaluation of fluidic systems or components resulting from in-house development and the following fluidic system contracts: A. Fluidic Environmental Control System. B. Fluidic Approach Power Compensator. C. Hydrofluidic Fluidic Control (Fly-By-Tube). D. Fluidic Autopilot for Sparrow III Missile. E. Hydrofluidic Yaw Damper for TH-57 Helo. F. Airborne Fluidic Power Sources. G. Fluidic Laminar Angular Rate Sensor (LARS) Optimization. H. LARS Laboratory Evaluation.

Supporting agency address information: Naval Air Systems Command 340, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0052, VOICE RECOGNITION AND SYNTHESIS SYSTEMS (VRASS) FOR NAVAL AIRCRAFT
R.J. WHERRY, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To determine the potential effectiveness and demonstrate feasibility of voice recognition (VR) and voice synthesis (VS) systems for selected aircrew stations. To develop, fabricate, test and evaluate a VRASS system.

Requirements for vocabulary size, structure, and syntax and requirements for verification feedback through the use of VS systems will be determined. Intelligibility testing, using standard

testing materials will be conducted with the VS/VR systems. A generic crew station incorporating VR and VS systems will be constructed and studies will be performed to determine feasible language communications between operators and airborne operators. Analysis of the LAMPS ATO's functional tasks will be accomplished to determine what keyset and display functions can be replaced by voice communications and a demonstration will be accomplished using NAVAIRDEVCEN's LAMPS simulator.

Supporting agency address information: Naval Air Systems Command 53344, Washington, D.C. 20360.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0053, REQUIREMENTS FOR INTERACTIVE VOICE CONTROL SYSTEMS
R.J. WHERRY, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974

To determine the necessary structure and elements of an interactive control language to allow operators to accomplish control functions and information reception functions through machine recognition and synthesis of voice.

Operator control and information reception tasks will be studied to determine feasible functions for interactive voice systems. Alternative language structures (i.e., differing syntax, formality of language, and vocabulary size) will be studied to determine impact on (a) operator of language flexibility, ease of communication and (b) hardware considerations, such as computer storage requirements, and processing times. Based on trade-off studies between desirability features of language and computer costs an optimal language structure will be recommended.

Supporting agency address information: Naval Air Systems Command 340F, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0054, INVESTIGATION OF INLET NOISE SUPPRESSION USING HIGH SUBSONIC MACH NUMBERS
E. LUMSDAINE, Univ. of Tennessee, Graduate School, *Knoxville, Tennessee* 37916 (NSG 1081)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0055, TECHNOLOGY ASSESSMENT OF PORTABLE ENERGY SOURCES
J.H. VANSTON, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (NAS 2-8444)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0056, THEORETICAL INVESTIGATION OF MAGNETOSPHERIC CONVECTION
R.A. WOLF, Rice University, School of Engineering, *Houston, Texas* 77001

Theoretical investigations and numerical modeling of electric fields and plasma flow in the ionosphere and magnetosphere will be carried out. Self-consistent time dependent computations will be made that include effects of partial ring currents in the magnetospheric plasma, horizontal currents in the ionosphere, and field-aligned currents connecting the two. A plasma sheet with both ions and electrons will be included, using observed energy spectra. Comparison of the model computations will be made with electric field measurements from polar orbiting satellites and the Chatanika, Alaska, radar measurements, particle data from satellite ATS-5 and S, and Birkeland current observations from the TRIAD satellite.

The theory of magnetic merging will be developed, as well as convection theory in the Jovian and Martian magnetospheres.

SUPPORTED BY U.S. Natl. Science Foundation

4.0057, ADDITION TO A STRUCTURAL ANALYSIS AND DESIGN SYSTEM
W.O. CARTER, Utah State University, School of Engineering, *Logan, Utah* 84321 (N62399-74-C-0005)

Develop conversational algorithms for structural analysis and design of two-dimensional concrete frames which are compatible with the existing conversational algorithms for structural analysis and design of two-dimensional steel frames. Provisions will also be made to design for seismic loads.

The algorithms will be developed and demonstrated as additional subprograms which are to be added to the existing structural analysis and design system (SADSY) computer code. The demonstration of the merits of the algorithms will be conducted within the university environment and in the design environment of the naval facilities engineering command.

Supporting agency address information: Civil Engineering Lab. (Navy) 151, Port Hueneme, Calif. 93043.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0058, ORBITAL PRECISION REQUIREMENTS FOR AN ALTIMETER SATELLITE
A. MANCINI, U.S. Army, Res. Institute, *Alexandria, Virginia* 22314

To determine the orbital precision needs of an altimeter-satellite such that the orbital information and altimeter-measurement can be combined to produce a vertical-deflection field of five arc seconds or less over ocean areas. Results to be used in total global gravity development for missile control, etc.

Analytical and numerical studies of variations and errors in satellite orbits due to high order terms of the potential will be made to determine if orbits over ocean areas can be extrapolated without observations to a comparable accuracy as the altimeter measurements made to the geoid surface. The study will concentrate more on the vertical variations of the orbit since these errors effect the altimeter observations more than the horizontal displacements of the orbit. The orbit altitude of the altimeter satellite will be taken as 500 nm and the orbital elements when the satellite approaches the ocean areas will be assumed to be perfect. The satellite inclination will be 90 degrees and the deflections are required at five nm intervals. Altimeter measurements will be assumed accurate to one to two meters.

Supporting agency address information: OCE ETL Research Institute, Alexandria, Va.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0059, BASIC RESEARCH IN ADVANCED ACOUSTIC SUPPRESSION CONCEPTS
A.H. NAYFEH, Virginia Polytechnic Institute, School of Engineering, *Blacksburg, Virginia* 24061 (NAS 3-18533)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0060, HOLOGRAPHIC COMPENSATION OF RESIDUAL ABERRATIONS IN OPTICAL SYSTEMS
W.R. GRAVER, U.S. Army, Mapping Developments Div., *Fort Belvoir, Virginia* 22060

The objective is to investigate the general imaging properties of a composite lens-holographic correction plate system. If the investigation is successful, a method will have been developed that can be use to eliminate spherical and other types of optical aberrations that cause image distortions. Uses to the Army may be in aerial cameras, projection systems, astronomic observational theodolites, and other similar equipment.

Composite lens-holographic correlator plate systems will be constructed and their properties observed. The analysis will include the recording of projected diffraction images of on and off axis point sources, the measurement of distortions in the imaged point sources, simulation of spot diagrams using imaged points with various pupil configurations, and the image resolvability of these systems. This is an expanded investigation of effort under Work Unit 91D-01-032, DA0K8047 (completed).

Supporting agency address information: OCE ETL Mapping Developments Div., Ft. Belvoir, Va. 22060.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0061, SELECTED AERIAL PHOTOGRAPHIC SAMPLING APPLYING ANALYTICAL PHOTOGRAMMETRY
G. LUKES, U.S. Army, Res. Inst., *Fort Belvoir, Virginia* 22060

The objective is to investigate the use of analytical photogrammetry to selectively sample quantized multiband/multidate aerial photography to provide data for computerized terrain classification studies. This technique will be useful for crop classification for DOD and civil agencies.

Techniques previously developed by the principal investigator will be applied to real data using the PbS microdensitometer. Experiments will selectively sample multidate color and/or-multiband aerial photography of Maricopa County, Arizona, and attempt to automatically classify crops utilizing time-variant spectral criteria.

Supporting agency address information: OCE ETL Research Institute, Ft. Belvoir, Va. 22060.

SUPPORTED BY U.S. Dept. of Defense - Army

4.0062, TURBULENCE CLOSURE MODELING FOR HIGH MACH NUMBER TURBULENT SHEAR FLOWS
G.L. GOGLIA, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1087)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0063, THERMAL-STRUCTURAL ANALYSIS OF SCRAMJET STRUCTURES
E.A. THORNTON, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1093)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production And Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, STUDY OF MAGNETOSPHERIC AND LABORATORY PLASMA PHYSICS EXPERIMENTS
C.C. SUNG, Univ. of Alabama, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-30563)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0002, LIGHTNING DETECTION STUDY
E.P. KRIDER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (NSG 5023)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0003, MAPPING OF WATERSHED CHARACTERISTICS BY REMOTE SENSING
A.D. FELDMAN, U.S. Army, Hydrologic Engineering Center, *Davis, California* 95616

The purpose of this project is to investigate the feasibility of using remote sensing technology to detect and map watershed characteristics. Both physical and hydrologic characteristics will be monitored and mapped, both urban/suburban and rural/agricultural areas will be studied. The data and information acquired from remote sensors will be coordinated with data obtained from conventional sources to study both areal and temporal variations in watershed characteristics.

Approach: Several watersheds will be selected to serve as pilot study areas. At least one watershed will display primarily urban/suburban land-use patterns, and at least one will be primarily rural/agricultural. Available historical data concerning precipitation runoff characteristics, streamflow volume, infiltration characteristics and soil-terrain features will be collected for each of the pilot areas. Through consultation with experts on sensory devices and from examination of available data a determination of the characteristics data to be collected by remote sensors will be made. The data collected for each of the pilot areas will be analyzed and coordinated with available historical data and with data collected by conventional methods to ascertain the value and utility of the data collected by remote sensors. Maps showing the areal variations of physical and hydrologic characteristics of each pilot watershed will be prepared. Procedures for applying remote data collection techniques to operational programs will be developed.

SUPPORTED BY U.S. Dept. of Defense - Army

5.0004, ENERGY CONVERSION - STUDIES OF POROUS BATTERY ELECTRODES
D.N. BENNION, Univ. of California, School of Engineering, *Los Angeles, California* 90024 (N00014-69-A-0200-4047)

Many battery electrodes are highly porous in order to create a large surface area and thereby to reduce losses associated with mass transfer and surface overpotential. It is the purpose of this research to identify, describe, and explain the controlling elementary processes which occur in a porous battery electrode with the objective of improving battery performance in naval applications.

The investigation will concentrate on experimental and theoretical studies of silver, silver chloride electrodes. Current density measurements will be made by sectioning the electrodes and measuring the current to each section directly. Optical and electron microscope observations of changes of the morphology of electrode surfaces will be made. Mathematical models simulating electrode processes will be developed.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0005, COMMAND AND CONTROL - REDUCTION OF COMPUTER REPROGRAMMING COSTS THROUGH TECHNIQUES FOR EFFICIENT CONVERSION ACROSS COMPUTER LANGUAGES (ABBREV)
P. GILBERT, Univ. of Southern California, Electronic Sciences Lab., *Los Angeles, California* 90007 (N00014-67-A-0269-0020)

The Navy Department has an enormous investment in computer programs. When a facility changes a program to a new and different machine the reprogramming cost is significant. In order to minimize this cost, new and more efficient methods of rewriting programs must be found. It is the objective of this task to explore, define, and formalize theoretical models which will provide techniques to attain this goal.

The approach is to define formal models of programming translation systems, and to study the properties of these models. The objective is to achieve translation models, and ultimately translator programs, which are formally adequate to accommodate input languages at least as complex as ALGOL or FORTRAN, whose behavior is formally verifiable, and which are efficient. In other words, the objective is a theory which is theoretically adequate, which is relevant to actual translation problems, and which can be 'carried through to practice' to yield efficient translation programs or machines. The input languages of translators constructed in this way will be machine-invariant.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0006, OBSERVATION, ANALYSIS AND PREDICTION OF MARINE FOG
D.F. LEIPPER, U.S. Navy, Postgraduate School, *Monterey, California* 93941

To cooperate with Cornell Aeronautical Laboratories in observing and describing the formation and dissipation of fog at sea; to relate synoptic-scale variables in Meteorology and Oceanography important in marine fog to microphysical characteristics; to improve the accuracy and utility of marine fog forecasts.

Observations of Meteorological and Oceanographic parameters significant to fog development and dissipation will be made at sea using NPS Ocean Research Vessel Acania. These will be re-

lated to synoptic- scale analyses for the atmosphere and ocean. Predictions for marine fog situations will be made using existing techniques; improved forecasting models will be developed based on observations and analyses above. Cal scientists and equipment will be carried to sea during two-week periods in August 1972 and February 1973.

Supporting agency address information: Naval Air Systems Command 370C, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0007, NAVY ENVIRONMENT - NUMERICAL MODELING OF DEEP-SEA TIDES

M.C. HENDERSHOTT, Univ. of California, Graduate School, *San Diego, California* 92038 (N00014-69-A-0200-6049)

The behavior of internal waves in the ocean is of interest to the Navy for ASW and sonar surveillance. Although the driving force of these waves is not now understood, one possibility is that they are the process by which tidal energy is dissipated. The goal of this study is the numerical prediction of tides in the world ocean which will allow determination of the distribution and mechanism of tidal dissipation.

A numerical model of global tides is developed which incorporates the effect of solid earth tides and its important interaction with oceanic tides. An observational program of tides in the Gulf of California will provide data which will test a regional version of the numerical model. Oceanographic measurements of density microstructure inversions are proposed to see whether the amount of overturning observed has any relationship to tides.

Supporting agency address information: Office of Naval Research 481, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0008, OCEAN REMOTE SENSING

J.R. APEL, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (83331055)

Project objective: To study ocean circulation, tides, waves and sea state from satellites, aircraft and ships using remote sensing techniques to conduct theoretical and numerical analysis of same. To define future satellite systems for ocean research.

Current year plan: Analyze ERTS-1, NOAA-2 & 3, Skylab, and Nimbus data for ocean surface and internal waves. Use acoustic echo sounding to study near-surface ocean features. Conduct cruises for verification of remote sensing techniques. Develop analytic tools. Coordinate future oceanographic satellite programs.

Progress report: Internal waves on spacecraft images and in acoustic records have been identified and models constructed of same. Theories of acoustic scattering were developed. The SEASAT-A spacecraft was defined and NOAA efforts in same coordinated.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0009, UPPER ATMOSPHERE STRUCTURE STUDIES

R.B. NORTON, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (8DJ46041)

Research/service objective: To investigate the upper atmosphere including the ionosphere and the magnetosphere.

Research/service plan: Analysis of OSO 10 occultation should be completed. Similar data from Skylab should be received and analyzed.

Progress report: Occultation data from OSO 6 and some data from SOLRAD 10 have been reduced to atmospheric density. The OSO data is low latitude and shows large day to day variations. Comparison of SOLRAD 6 and 10 data shows a sunspot cycle variation in O2 density in the lower thermosphere.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0010, DOPPLER LIDAR DEVELOPMENT

R. SCHWIESOW, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (8AA73035)

Project objective: Develop a field Doppler lidar velocity measuring system for studies of boundary layer dynamics, mountain lee waves and vortex phenomena.

Current year plan: Mount Doppler Lidar in vehicle. Develop data processing. Begin measurement of velocity in atmosphere.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0011, DETERMINATION OF TROPOPAUSE CHARACTERISTICS

O.N. STRAND, U.S. Dept. of Commerce, Wave Propagation Laboratory, *Boulder, Colorado* 80302

The investigator followed the objectives outlined in the work agreement very closely. The Backus-Gilbert and regression techniques were pursued with the latter technique proving to be more useful than the former. Specifically, when using linear regression on the radiances, the standard error in the determination of tropopause height and temperature were 1.17 km and 4.8 degrees C, respectively. When the sample set was broken down into a high latitude set and a low latitude set, the numbers became 1.62 km and 5.5 degrees C, and .53 km and 2.9 degrees C, respectively. The results were insensitive to changing the zenith angle from 0 degrees to 23 degrees, and relatively insensitive to changing the RMS noise level from zero to 0.25 mw. On the other hand, the results depend strongly on what is used as the first-guess profile.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0012, THUNDERSTORM DETECTION

K. WILK, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (8C370404)

Project objective: Design, install, and test a network of surface stations capable of digitally recording and telemetering the wind speed and direction suitable for immediate mesoscale observation of the low level airflow in the environs of severe storms. In addition, provide accurate, compiled data fields of wind velocity, temperatures, pressure, humidity, and rainfall in a form suitable for post mesoscale synoptic analysis of severe storm periods. Operate a tall meteorological tower and radiosonde station and obtain meteorological profiles of wind, temperature, and humidity in the lower and middle troposphere during severe storm periods. Continue the analysis of severe storm events, including hailfalls, heavy rainfall, tornadoes, and strong wind gusts and relate these events to the quantitative weather radar data. Develop techniques for the analysis, display, and tracking of severe storm events for the improvement of severe thunderstorm warnings.

Current year plan: Continue the collection and analysis of severe storm events including surface wind gusts, heavy rainfall, and hail. Analyze the radar reflectivity data to determine the motion, predictability and water output characteristics of the severe thunder storms associated with the events.

Progress report: The development and testing of digital processing and recording equipment for the tower and remote surface sites is continuing. The characteristics of radar and surface network observations collected during severe rainstorms were analyzed and documented for publication. Computer processing techniques were developed for combining quantitative radar and raingage data to produce a more detailed and accurate precipitation map. This technology was transferred to the Office of Hydrology, National Weather Service for operational application.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0013, NOISE PROPAGATION INTO BUILDINGS

D.S. PALLETT, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Architects and builders seek technically reliable means of analyzing and controlling noise propagation into buildings in order to provide adequate isolation against noises of external origin. No unified analysis of the problems related to design against these noises presently exists, and very little relevant research is being conducted. This program is directed toward the conduct of essential research, and to the publication of a unified, coherent design guide addressing these issues. A report describing acoustical and thermal properties of building shell components has been prepared, research is in progress, and the text of the design guide is in preparation.

Objective: To improve present methodologies for measuring noise isolation provided by barriers, terrain, vegetation, and building shells. To provide techniques for predicting sound propagation from exterior noise sources into occupied spaces. To provide evaluated engineering data and information to assist designers in providing protection against noise of exterior origin.

Motivation: Noise of exterior origin, particularly from aircraft and traffic, is a source of major complaints throughout the country. Such noise has been quite influential in prompting the numerous anti- noise regulations that have recently been passed. While much attention is being directed toward quieting noise sources, there is general agreement that attention must also be given to means for noise attenuation and isolation. Relatively little research has been carried out in this area and designers do not presently have access to reliable, evaluated engineering data.

Approach: In order to enable improvement of present measurement methodologies for noise isolation provided by barriers, building shells, etc., research efforts are directed toward development of more complete understanding of building acoustics and predictive methods for use in quantitative evaluation of noises of exterior origin. These research efforts will provide the essential technically reliable basis for the implementation of noise control engineering in buildings and will provide designers and builders with increased understanding of the acoustical properties of noise sources and building shells.

Progress: A report entitled 'Sound and Thermal Transmission and Air Infiltration of Residential Exterior Walls, Doors, and Windows,' prepared under contract for NBS, has been editorially adapted. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0014, INTERIOR NOISE OF BUILDINGS
D.S. PALLETT, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Occupant dissatisfaction due to noise in buildings has become increasingly apparent. Present interior noise measurement methodologies are sometimes controversial and are inadequately precise. This project is directed toward amelioration of this situation. Recent attention has been devoted to a critical review of the state-of-the-art in impact noise testing and to the development of analytic procedures and instrumentation for the study of physical phenomena involved in impact noise generation. An extensive critical review of the state-of-the-art on this topic is to be adapted and published within the next year and the relevant research will continue.

Objective: To improve present methods for measuring and controlling noise generation and propagation in and between interior spaces in order to provide essential technically reliable noise measurement procedures to industry and government.

Motivation: Noise in buildings is a major cause of occupant dissatisfaction resulting in increased pressure for implementation of noise control in buildings. This project on interior noise in buildings is directed toward provision of improved measurement methods needed for the implementation of these control procedures. Initial recipients of benefits resulting from evolution of improved measurement methodology will be the building industry; long term benefits are expected to accrue to inhabitants of buildings incorporating noise control procedures facilitated through improved measurement procedures. No substantial amelioration of the presently imprecise measurement methodology is anticipated unless NBS continues to advocate the evolution of improved methodologies and to provide leadership to this end.

Approach: Research is being conducted upon vibration and acoustical properties of building systems and upon the related building acoustics problems in order to develop and to provide industry and government with a sound technical basis for control of building noise. The intent of this research is to improve measurement procedures, understand human response criteria, and indicate applications of noise control technology.

Progress: A critical review of the state-of-the-art in impact noise testing and rating was completed under contract and a meeting to discuss the state-of-the-art with NBS and HUD representatives was held.

Testing of computer codes for the analytic prediction of the vibration properties of model floor-ceiling assemblies was accomplished. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

5.0015, METOROLOGICAL PROCESSES (CLOUD AND FOG PHYSICS)
W.A. HOPPEL, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Provide new and improved capabilities to the Navy in its functions of predicting and modifying fog and rainfall. Achieve a better understanding of cloud and fog dynamics, glaciation, condensation processes, electrification, and the role of cloud condensation nuclei (CCN) in clouds and marine fog.

Theoretical modeling, laboratory studies, and field experiments are used to determine the characteristics of natural and artificially modified clouds and fog. Improved techniques and instruments developed under work units A03-14.302 and A02-15.302 are used to measure fog, cloud and precipitation drop size, water content, temperature, CCN composition, number, and sources, and to determine how CCN are affected by pollution and how they affect fog and cloud physics.

Supporting agency address information: Naval Air Systems Command (NAVAIR 370), Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0016, STRUCTURE OF BOUNDARY LAYERS AND TURBULENCE WITH APPLICATION TO DRAG REDUCTION, NOISE GENERATION, AND WAKE DETECTION
T.T. HUANG, U.S. Navy, Ship Performance Department, *Washington, District of Columbia* 20034

To determine the structure of hydrodynamic turbulence in boundary layers, wakes, and jets, with emphasis on data relevant to drag reduction, noise generation, wake detection, diffusion, and other problems arising in the Naval sciences. This project is required in order to improve the Navy's ability to provide Naval vehicles having reduced drag, reduced noise, and improved concealment characteristics.

Turbulence structure will be investigated experimentally and analyzed by both digital and analog methods to determine the statistical characteristics of wakes, jets, and turbulent boundary layers, with and without polymers. Measurements will be made with and without polymers present in a 2-inch pipe, including turbulence velocity structure using a laser doppler velocimeter and the pressure fluctuations on the wall using flush-mounted hydrophones. The turbulence structures with and without polymer drag reduction will be compared and examined in the light of current turbulence theories to understand the underlying physical processes, their origin and nature. In order to verify the statistical theories of turbulence at high Reynolds numbers, detailed measurements, and computations of grid (wake) turbulent structure will be made in the center's 36-inch water tunnel.

Supporting agency address information: Naval Ship R&D Center 01, Bethesda, Md. 20034.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0017, WEATHER MODIFICATION AND CONTROL (SPECIAL AIRCRAFT INSTRUMENTATION)
R.E. RUSKIN, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Improve the operational capability of the Navy in its functions of weather and fog forecasting and modification for safety of its ships and planes by development of new and improved airborne and shipboard instrumentation for fog and cloud measurements of liquid water, cloud and fog droplet sizes and the number of cloud condensation nuclei (CCN). Obtain sufficient accuracy and resolution to differentiate between natural and artificially-induced weather phenomena.

Exploratory development is conducted using proposed new principles for fog and airborne cloud-physics instruments. These developmental models of the instruments subsequently used in field fog and cloud studies which are performed under work unit A03-14.301. Some instruments are further developed under A03-14.303.

Supporting agency address information: Naval Air Systems Command (NAVAIR 370), Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0018, ENVIRONMENTAL MEASURING EQUIPMENT IMPROVE POLAR AUTOMATIC WEATHER STATION (PAWS)
W.A. VONWALD, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

Develop experimental equipments for telemetering meteorological data from remote or inaccessible areas of special interest to the Navy for tactical purposes or to support research programs.

Explore various means for telemetering meteorological and oceanographic data. Design experimental equipments to assess the feasibility of increasing the capability of existing equipments to meet the needs of the Navy. Conduct laboratory and field trials to determine the reliability and accuracy of the experimental equipments. Deploy telemetering equipments to support Naval operations or research programs.

Supporting agency address information: Naval Air Systems Command (NAVAIR 370), Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0019, RESEARCH IN GEOLOGICAL-VEGETATIVE RELATIONSHIPS
D.D. ARDEN, Georgia Southwestern College, Undergraduate School, *Americus, Georgia* 31709 (NAS 8-30884)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0020, A WINTER WHEAT YIELD MODEL
A.M. FEYERHERM, Kansas State University, School of Arts, *Manhattan, Kansas* 66502 (NAS 9-14282)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0021, NOISE CONTROL IN WOODWORKING INDUSTRY
R.C. TANG, Univ. of Kentucky, Agricultural Experiment Sta., *Lexington, Kentucky* 40506 (KY00610)

Objective: Determine and analyze sources of noise in use of woodworking equipment. Develop damping system for woodworking machinery for reductions of sound radiation from board vibrations. Determine effectiveness of barriers and acoustical enclosures on noise reduction in woodworking machines.

Approach: Noise produced in operation of woodworking machinery will be recorded and analyzed by a spectrum analyzer to determine frequency distribution. Sound velocity and sound wave resistance of various species of wood will be determined through the use of an Arenberg oscillator and Tectronix oscilloscope. Various types of damping systems will be designed for reduction of sound radiation and their effectiveness analyzed. Attenuating acoustical structures will be constructed around different machines in accordance with the analysis of noise produced from the machine and their effectiveness analyzed as to noise reduction.

Progress: An economical and practical noise reduction system, including an acoustical enclosure, damping devices, and attenuators for a single-surfacer 20-inch planer has been designed at a total cost of $350. The enclosure system significantly reduces the noise level. Continuous research on a noise reduction system for a double-surfacer planer has been installed at our Wood Utilization Center.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0022, RESOURCE IDENTIFICATION STUDIES ON URBAN WATERSHEDS USING THE ANACOSTIA RIVER BASIN AS AN EXAMPLE
R.M. RAGAN, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (NSG 5017)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0023, COMMUNICATIONS - ULTRA-LOW RADIO FREQUENCY SIGNALS
T.R. MADDEN, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (N00014-67-A-0204-0045)

This work unit provides background data useful for Naval low- frequency radio communications and detection systems by investigating the properties of small variations in the earth's magnetic field known as micropulsations. The amplitudes, frequencies, noise characteristics and propagation characteristics of these variations, which appear as electromagnetic waves, determine sensitivity and range of electronic systems which operate in the extremely-low-frequency region of the spectrum.

Characteristics of 'whistlers' and other types of geomagnetic micropulsations are studied. These characteristics are learned by observing the influence of the micropulsations on earth currents. Electrodes in the ground measure telluric currents. These are correlated with solar and magnetospheric effects.

Supporting agency address information: Office of Naval Research 427, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0024, RESEARCH IN MARSHLAND ECOLOGY
F.R. NELSON, Jackson State College, Graduate School, *Jackson, Mississippi* 39217 (NSG 9016)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0025, IMAGING NATURAL MATERIAL WITH A PLANETARY LANDER QUASI-MICROSCOPE
R.E. ARVIDSON, Washington University, School of Arts, *St. Louis, Missouri* 63130 (NSG 1084)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0026, DRY GEOTHERMAL SOURCE DEMONSTRATION
M.C. SMITH, Univ. of California, U.S.A.E.C. Los Alamos Sc. Lab., *Los Alamos, New Mexico* 87544

Description: The proposed project consists principally of creating and operating a field demonstration of the feasibility of extracting geothermal energy from dry, hot rock beneath the earth's surface by means of a pressurized-water circulation loop produced by drilling two holes and connecting them at depth through a large crack system made by hydraulic fracturing. An area apparently suitable both technically and environmentally for such a demonstration has been identified on the Jemez Plateau of North-Central New Mexico, and geologic, geophysical, and hydrologic investigations of it are continuing. A test well has been drilled to 6350 ft. Further drilling will be undertaken.

SUPPORTED BY U.S. Atomic Energy Commission

5.0027, INVESTIGATION OF RELATIONSHIP BETWEEN LINEARS AND PETROLEUM PRODUCTION IN THE WILLISTON BASIN
J.M. ERICKSON, St. Lawrence University, Graduate School, *Canton, New York* 13617 (NSG 5018)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0028, APPLICATION OF LUNR SYSTEM TO FLOOD PLAIN ANALYSIS AND MANAGEMENT IN THE SUSQUEHANNA RIVER BASIN
J.W. KELLEY, Cornell University, Agricultural Experiment Sta., *Ithaca, New York* 14850 (NYC-147313)

Objective: Develop a procedure for utilizing technical aspects of New York State Land Use and Natural Resources (LUNR) system more effectively in water resources planning and more specifically in terms of flood plain management in the Susquehanna River Basin.

Approach: The Elmira-Horseheads New York region will be the study area. The research will include manipulation of actual

LUNR inventory data, identification of decisions and display procedures. Emphasis will be placed on flood plain identification and characterization via remote sensing, data use for water planning needs and an evaluation of feasibility of developing an improved LUNR system for the Susquehanna River Basin.

Progress: Research has been completed and a preliminary report has been prepared which discusses the characteristics of the LUNR system and feasibility of application to the Susquehanna River Basin including an overview of the LUNR system; LUNR chronology; technical and cartographic considerations; classification of inventory items; computer aspects of LUNR process; innovations; expenditure estimates and user services and, examples of LUNR applications to the Susquehanna River Basin including watershed management; land use monitoring, scale analysis; pollution identification and surveillance; environmental impact statements and other potential uses of LUNR. Preparation of final report is well under way with an anticipated completion date on or before 15 February 1974.

SUPPORTED BY New York State Government - Albany

5.0029, THE LINKING OF MULTISCALED ENERGY SOURCES LEADING TO ATMOSPHERIC DEVELOPMENT
D.A. PAINE, Cornell University, Agricultural Experiment Sta., *Ithaca, New York* 14850 (NYC-125309)

Objective: Investigate gravity wave phenomena as a primary link between cumulus-scale energy sources and those features characterized by medium and large-scale wavelength. Show that currently available data and diagnostic tools are sufficient to define the influence of long gravity waves with the wind, pressure and precipitation fields. Prove that gravity wave phenomena organize energy generated at the cumulus scale while interacting with synoptic-scale features. Provide short- range predictability of severe storms by forecasting the development of mesoscale wave phenomena.

Approach: Preliminary Data for 15 moderate to severe lake-effect snowstorms has been compiled to serve as input into computer programs coupling the medium and mesoscale. One of these programs is an equivalent Barotropic Model running upon a 127KM grid spacing; the other numerical scheme computes the mesoscale momentum field over a 32KM interval.

Progress: A numerical model has been developed to predict intense mesoscale squall-lines. Test cases include lake-effect snow-squalls, the devastating tornadic outbreak of Palm Sunday 1965, and the heavy rains produced over central New York by tropical storm Agnes. The ten- level model simulates adiabatic heating, latent heating, surface heat flux, condensation, evaporation, precipitable water calculations, surface moisture flux, frictional stresses and orographic forcing. The goals of this National Science Foundation grant include an improved understanding of severe convective storms to provide short-range predictability of excess precipitation and damaging winds.

SUPPORTED BY New York State Government - Albany

5.0030, NAVY ENVIRONMENT - COASTAL DATA DISPLAY
L.A. GERHARDT, Rensselaer Polytechnic Inst., School of Engineering, *Troy, New York* 12181 (N00014-67-A-0117-0019)

It is the prime objective of this research to formulate, design, develop, fabricate, test and evaluate a real time, on line digital signal processing system which will display the time varying spectrum of non-stationary processes as they dominate the conditions in coastal areas. This system will be oriented towards the study of coastal processes including the study and analysis of waves (surf beats, fetch limited wave spectra among others), winds, currents, and will be designed to be compatible with sensors now in use for measuring these, adapted to the frequency content of the processes. The system will provide the possibility to extract specific information on demand and will provide a significant advancement to data handling for all inshore warfare and other coastal operations and missions.

The system will get its inputs from a variety of sensors. These inputs will be fed into an array of four basic parts: a console, a color display, operation controls and drawers. The system will be engineered from a human factor's viewpoint and manipulation of all operating controls will be possible while monitoring the display. The functions will be flexible to adapt to the given research task. Fast Fourier transform, tracking of predominant frequency structures as a function of time, optimization of the window function for weighting the data, and similar design parameters will be incorporated as they affect particular applications. A color TV screen is used for display, and the techniques for color coding will be applied which have been developed previously by the principal investigator (partially under contract with ONR 465).

Supporting agency address information: Office of Naval Research 462, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0031, RAPID MAPPING OF LAND USE BASED ON REMOTE SENSED DATA
F.Y. BORDEN, Penn. State University, Agricultural Experiment Sta., *University Park, Pennsylvania* 16802 (PEN01931)

Objective: Develop a system of rapid classification and mapping of land use based on aerial photographic and multispectral remote sensed information.

Approach: Using computers and other specialized automatic image analysis equipment, aerial photographs, multispectral imagery and digitized imagery, data will be analyzed by multivariate statistical methods and by machine-researcher interactive means to produce map displays of land use patterns such as forest types, agricultural and non-agricultural open land as two of many examples.

Progress: A data processing system for analysis of digital multispectral scanner data was used on ERTS-1 data for land use classification and resource inventory as follows: urban, suburban, industrial, and rural; forest types; vegetative cover; and deep mine refuse, strip mines, water types, vegetation, and urban. A mix of supervised and unsupervised classifiers was found more useful than either used exclusively. Satisfactory results were generally found, but one major target confusion was apparent. Agricultural areas dominated by small fields were generally confused with low- to medium-density suburban targets. Computer classification can be done at about $.05 per square mile for ERTS data. Preliminary maps have been produced for the Southern and Middle Anthracite Coal Fields of Pennsylvania showing the location and extent of deep mine refuse banks as well as associated strip mines and urbanized areas. Remote sensor data are limited to the classification and mapping of targets based only on their spectral characteristics and resolution. Other data are often available in map form, but must be put into a machine-processable form to merge with remote sensor data to use for land use classification. Computing equipment for inputting and outputting maps was reviewed. A system was specified to allow map data to be put into computable form through a hand-manipulated, tracing digitizer, to be edited during and after input by an interactive cathode ray tube terminal and to produce line maps at high speed. Map processing software was evaluated to be used in conjunction with the remote sensing data processing system for the rapid generation of land use maps.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0032, METHODOLOGICAL FACTORS IN PERFORMANCE ASSESSMENTS OF TIME-VARYING AIRCRAFT NOISE EFFECTS
E.A. ALLUISI, Old Dominion University, Graduate School, *Norfolk, Virginia* 23508 (NSG 1092)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

5.0033, MULTIDISCIPLINARY STUDY OF WYOMING TEST SITES USING SKYLAB/EREP DATA
R.W. MARRS, Univ. of Wyoming, School of Arts, *Laramie, Wyoming* 82070

The purpose of the investigation is to research applications of the various forms of Skylab/EREP data to natural resources inventory and management. These include geologic, vegetative, and hydrologic applications related to earth resource studies. The major components of the hydrologic studies are: 1) mapping snow cover for estimation of snow-pack moisture reserves, using visible

and near-infrared band imagery, 2) mapping near surface ground water anomalies from thermal data, and 3) determining relative quantity and distribution of water stored in lakes and reservoirs.

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, BLOOD INSULIN - BINDING
UNKNOWN, Stanford University, Graduate School, *Palo Alto, California* 94305 (NAS 2-8513)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0002, PERSONNEL TECHNOLOGY - LEARNING PROCESSES IN NETWORK-BASED, COMPUTER-ORIENTED SELF-CONTAINED EDUCATIONAL SYSTEMS
D.A. NORMAN, Univ. of California, Computer Center, *San Diego, California* 92037 (N00014-69-A-0200-6045)

Problems faced by the Navy in the teaching of subject matters are compounded by the fact that students come from varying cultural and educational backgrounds and thus start with great variability in their initial knowledge and motivation. A network model of human memory, modeling both the semantic and the syntactic structure and procedures of the information to be learned and of a student's changing knowledge, forms the basis of the proposed educational and training program. Such a representation allows efficient match of the student's unique capabilities with the material to be learned. In turn, the training program provides a living laboratory in which to refine the underlying theory of memory.

This work will use computer-controlled visual display and hard-copy terminals to develop and teach self-paced, individualized courses, with methodology derived from the network model of human memory. The performance of computer implemented network models will be compared with the performance of actual students and tutors in order to guide the development of the models. The automated educational systems are both an experimental tool to construct and test the models, and an area for application of the results.

Supporting agency address information: Office of Naval Research 458, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0003, RESEARCH ON REACTIVE TOXICITY OF PYROLYSIS EFFLUENTS
A. MORECI, Univ. of California, Graduate School, *San Francisco, California* 94122 (NSG 2039)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0004, COMMAND AND CONTROL - COMPUTER CONTROLLED SPEECH SYNTHESIS
I.G. MATTINGLY, Univ. of Connecticut, School of Liberal Arts, *Storrs, Connecticut* 06268 (N00014-73-C-0264)

Automated techniques and equipments which will provide speech recognition and speech synthesis are vitally needed in a progressive Navy. For example, with the proliferation of shipboard and airboard controls, use of voice actuated devices could bring about more rapid control while at the same time minimizing the actuation of wrong instruments or controls. Conversely, speech synthesis could bring into being voice warnings of equipment dangers, improper adjustments, and many other similar forms of voice information. The emphasis in this task is the generation of automatized synthesized speech.

The approach will be the development of flexible and versatile computer programs to control an experimental speech synthesizer. The experimental system will be incorporated into studies in the generation of phonetics.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, EFFECT OF PHYSIOLOGICAL STATE OF BACTERIAL CELLS ON THE BACTERIAL TITER IN URINE SAMPLES BY LUCIFERASE ASSAY FOR ATP (ABBREV)
V. BUSH, Delaware State College, Undergraduate School, *Dover, Delaware* 19901 (NSG 5007)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0006, INVESTIGATIONS OF USE OF SPEECH MODULATED WHITE NOISE TO DIFFERENTIATE HEARERS AND FEELERS AMONG LISTENERS
H. TOBIN, Gallaudet College, Graduate School, *Washington, District of Columbia* 20002 (NSG 5019)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0007, INVESTIGATIONS OF NONINVASIVE ECG SYSTEMS
E.J. FISCHMANN, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NGR 09-011-055)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0008, HUMAN PERFORMANCE MEASUREMENT IN AIR SYSTEMS
I. GOLDSTEIN, U.S. Navy, Training Equipment Center, *Orlando, Florida* 32813

To improve control of the training process and of computer-based training systems in particular through development, test and evaluation of a comprehensive subsystem for the measurement of human performance. The availability of precise and relevant assessment structures can increase training effectiveness by giving a true picture of skill acquisition level at any point in the training process.

Identify appropriate training settings; select a class of desired trainee behaviors for exhaustive analysis; define and implement a measurement structure based on a measurement subsystem of adequate complexity; conduct empirical tests to evaluate techniques for discriminating among candidate members of a measurements pool; investigate the utility of highly refined measurement subsytems in training process control, e.g., ability to predict the trainee's readiness to transfer.

Supporting agency address information: Naval Air Systems Command 340F, Washington, D.C. 20361.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0009, STUDY OF INFLUENCE OF AMINES ON DIURNAL TOXICITY OF STIMULANTS & DEPRESSANTS
C.A. WALKER, Florida Agric. & Mech. Univ., Graduate School, *Tallahassee, Florida* 32307 (NSG 2029)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0010, PERSONNEL TECHNOLOGY - DEFINING THE CONDITIONS WHICH CONTROL HOW WELL TEXT MATERIAL IS LEARNED AND HOW LONG IT IS REMEMBERED
B.J. UNDERWOOD, Northwestern University, School of Arts, *Evanston, Illinois* 60201 (N00014-67-A-0356-0010)

Much of Navy training requires the acquisition and comprehension of written information. This research aims at developing a model of human learning of, and memory for, verbal material. Such a model is needed to improve instructional procedures and learner strategies in Navy training. This effort also envisages the possibility of memory-aptitude' tests, and thus holds promise for new personnel-selection criteria.

Principal investigator has developed a series of experiments to investigate the roles of memory attributes and learn how they

act as discriminators and retrieval agents for memory items. Five specific problem areas will be addressed in the coming phase: (1) the attributes beyond frequency involved in recognition memory; (2) experiments which view associations of contingent frequency discriminations; (3) studies of unlearning; (4) list differentiation and retention; (5) conceptual habits and retention.

Supporting agency address information: Office of Naval Research 458, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0011, NAVY VEHICLE DESIGN AND CONSTRUCTION - DYNAMIC CONTRAST REQUIREMENTS
M.J. KREBS, Honeywell Incorporated, *Minneapolis, Minnesota* 55408 (N00014-74-C-0076)

The concepts of a modulation transfer function of an image, and visual contrast demand function, of the observer have recently been shown to be very useful for design and performance prediction of display systems. It is desired to extend this methodology to dynamic (time varying) displays. The program objective is to determine the visual contrast requirements as a function of both temporal and spatial frequencies.

Patterned visual stimulus will be intermittantly presented to the subject. The minimum contrast required for detection will be recorded for a range of temporal and spatial frequencies. Variations in adaptation level, retinal position, and color will be investigated.

Supporting agency address information: Office of Naval Research 461, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0012, PERSONNEL TECHNOLOGY - QUANTITATIVE MODELS FOR PREDICTING HUMAN VISUAL PERCEPTUAL/MOTOR PERFORMANCE
W.H. TEICHNER, New Mexico State University, School of Arts, *Las Cruces, New Mexico* 88001 (N00014-70-A-0147-0002)

Quantitative models of human performance are extremely useful in the design of man-machine systems and point the way for most effective and efficient improvements as technology changes; and it is in the domain of display-control design that technology is advancing swiftly. This program on the development of visual search models promises to assist in the recognition and fullest development of display design improvements.

Empirical functions and limited visual models are developed for: probability of detection; simple reaction time; searching for simple and complex targets, with and without noise; choice reaction time; search over time; eye movements; identifying targets in simple or group categories, with and without noise. These are interconnected to develop more general equations. A model which incorporates the more general equations is used to predict search behavior in complex tasks that can be viewed as combinations of the above functions. A data base of these complex tasks, as found in the general literature, is analyzed for a test of the model and the results are used to reformulate the limited models as indicated, as well as the limited and general equations.

Supporting agency address information: Office of Naval Research 455, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0013, MEDICAL APPLICATIONS OF SPACE-RELATED RESEARCH
J. BELJAN, Wright State University, Graduate School, *Dayton, Ohio* 45431 (NSG 2034)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0014, PERSONNEL TECHNOLOGY - MATHEMATICAL METHODS IN MANPOWER MANAGEMENT
A. CHARNES, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (N00014-67-A-0126-0008)

This research is directed toward applying mathematical optimization methodology to the Navy's civilian and military planning functions and toward providing techniques to more effectively coordinate the two functions.

This research is attempting to merge modern techniques for optimization of large scale systems with behavioral science methods for acquiring job-relevant data to produce a manpower management system that incorporates both organizational and individual requirements. The work will involve the continued improvement and refinement of a static organization model and the design and initial development of a dynamic model, that is, a model that considers several time periods.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0015, EFFECTS OF CHRONIC STRESS ON THE CHEMISTRY OF BRAIN AMINES
W.W. MORGAN, Univ. of Texas, School of Medicine, *San Antonio, Texas* 78229 (NSG 9012)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NAVY VEHICLE DESIGN AND CONSTRUCTION - INTERACTIVE GRAPHICS PRE- AND POST-PROCESSOR PACKAGE FOR USE IN FINITE ELEMENT ANALYSIS
H.A. KAMEL, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (N00014-67-A-0209-0016)

The current effort is directed towards the development of a general purpose analysis package aimed specifically at ship structure design using the finite element method on a time-sharing system. The design constraints are: (a) minimum core utilization, to ensure high priority on a large time-sharing computer system; (b) low cost graphics terminals, to allow access to a large number of users with minimum capital outlay; and (c) inherent flexibility so that the program may be expanded and maintained in response to user demands and hardware innovations.

The concept of a general purpose collection of structures programs, coupled with a 'unified data base' (UDB) which contains data describing the problem at hand and is stored on disk as a set of files of standard format, was selected as the basis for the research investigation. similar format has since been recommended by NASA in their IPAD (integrated programs for analysis and design system).

Supporting agency address information: Office of Naval Research 474, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0002, NAVY VEHICLE DESIGN AND CONSTRUCTION - SINGULAR PERTURBATION THEORY FOR CONTROL DESIGN
E. OMALLEY, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (N00014-67-A-0209-0022)

This task will develop techniques useful in a large number of Naval design problems characterized by mathematical models requiring so-called singular perturbations. These include flow past bodies in which boundary layers are present and certain control systems with nonlinearities, high order or singular extremals.

A unified development of singular perturbation theory will be sought for use by scientists and engineers requiring such analysis in applications, as well as the asymptotic solution of specific problems arising in applied fields such as optimal control theory.

Supporting agency address information: Office of Naval Research 432, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0003, NAVY MANPOWER R&D - MATHEMATICAL AND ECONOMICAL MODELING FOR MANPOWER PLANNING
R.M. OLIVER, Univ. of California, School of Engineering, *Berkeley, California* 94720 (N00014-69-A-0200-1055)

This research is directed towards providing mathematical and economical techniques and procedures for the development, testing, and evaluation of alternative Navy manpower planning policies and practices.

This research is concerned with the development of fundamental relationships between the major components of the manpower planning process. Using techniques from statistics, mathematics, and economics, the research will concentrate on models for evaluating manpower requirements from the point of fixed requirements based on J. C. S. Navy missions, as well as determining requirements through the Navy ship and shore manning documents. The models will employ interactive computer technology as the primary means for displaying as well as applying the research.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0004, COMMAND AND CONTROL - RESEARCH ON MATHEMATICAL METHODS OF INTEGER PROGRAMMING
A.M. GEOFFRION, Univ. of California, School of Business Admin., *Los Angeles, California* 90024 (N00014-69-A-0200-4042)

This research is directed toward the development of mathematical techniques for solving Naval logistic and scheduling problems where discrete integer solutions are required.

The research will focus on several important areas of integer programming. These include devices for the acceleration of the branch- and-bound method, which is the most successful for integer programming, and means of decomposing large-scale problems into sequences of smaller, more manageable problems. Research will also be conducted on parametric and post-optimal analysis of integer programs.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0005, DYNAMIC INVENTORY MODELS AND RELATED OPTIMIZATION METHODS
A.F. VEINOTT, Stanford University, School of Engineering, *Palo Alto, California* 94305

The research will be concerned with dynamic inventory models and related optimization techniques for a number of problems. The problem of characterizing qualitative properties of optimal inventory and maintenance policies, among others, often reduces to finding when the optimal solution of a mathematical program is an increasing function of its parameters. The characterization of problems with this property will be investigated. Single and multi-product inventory models will be studied with attention focused on qualitative properties of the optimal schedules and on devising efficient computational techniques for finding them. The importance of D-Schur Convex Functions for inventory control is that certain optimization problems involving such functions can be solved explicitly with very little computation. New applications will be sought, and the properties of these functions will be developed. Markovian decision processes have broad application to inventory control and many other areas. A variety of problems in this area will be studied including maximum growth of expected utility and sensitive optimality criteria. The problem of sequentially scheduling projects with uncertain task durations will also be considered.

SUPPORTED BY U.S. Natl. Science Foundation

7.0006, CFM FABRICATION TECHNIQUES DEVELOPMENT AND CFM MEMORY PLANE FABRICATION AND TESTING
J. KEENAN, Ampex Corporation, *Redwood City, California* 94063 (N62269-73-C-0655)

The objective of this task is to develop TASK/RAM computer memory hardware for proving the feasibility of CFM (closed flux memory) memory system.

A partially populated memory model was built, together with necessary test electronics to exercise the memory model. From this effort, enough data was obtained to accurately predict the performance of a complete memory module. Based on results of N62269-72-c,0807 contract (temperature characterization of CFM planes), a two-phase contract was negotiated with ampex. Phase I shall consist of the cfm plane fabrication technique development and phase II shall consist of finalizing the CFM plane fabrication; delivery to NAVAIRDEVCEN of 50 fully populated CFM planes with documented test results. This phase shall be performed contingent upon satisfactory completion of phase I.

Supporting agency address information: Naval Air Development Center, Aero-Electron Tech. Dept. 2071, Warminster, Pa. 18974.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0007, COMMAND, CONTROL - MAN-MACHINE INTERACTION IN ADAPTIVE COMPUTER-AIDED CONTROL SYSTEMS
A. FREEDY, Perceptronics Incorporated, *Van Nuys, California* 91316 (N00014-72-C-0093)

Continuous decision-making and control in man-machine systems strain human performance under extreme work loads, emergency demands, and hazardous conditions. Computer-aided systems can unburden the operator by sharing the decision and control functions. Significant advancements in the effectiveness and reliability of Navy systems appear attainable through adaptive man-machine systems in which computers learn control tasks from operators and ultimately may achieve fully autonomous control. This research systematically examines man-machine interface variables and performance measurement techniques in an adpative man- computer system concerned with position and movement control.

The research utilizes manual control tasks consisting of a series of positioning movements which must be accomplished in a particular sequence. The operator learns to accomplish the tasks by controlling a cursor dot on an oscilloscope screen by means of a joystick. An adaptive computer program, interfacing with the positioning task, contains a matrix of conditional probability values which are modified as a result of correct and incorrect movements, and autonomous control (subject to operator override) is achieved when a preset level of confidence is reached. A secondary task increases the workload and provides the incentive for the subject to transfer control in the primary task to the computer. Performance measures are obtained under varying conditions of task difficulty, computer program parameters, and information feedback to the subject.

Supporting agency address information: Office of Naval Research 455, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0008, STATISTICAL AND MATHEMATICAL THEORY OF PROBLEMS OF COMMUNICATIONS AND FACTORIAL EXPERIMENTATION
J.N. SRIVASTAVA, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80521

This is a continuation of research previously supported under GP- 40583.

R.C. Bose and J.N. Srivastava will continue their development of the mathematical structure for application to advances in coding and design of experiments. Among the specific topics to be considered are solution of new cases of the packing problem; generalized partial geometrics and designs using graph theoretic methods; and search designs.

SUPPORTED BY U.S. Natl. Science Foundation

7.0009, CHARACTERISTIC FUNCTIONS AND THEIR APPLICATIONS IN MATHEMATICAL STATISTICS
E.S. JOHNSON, Fed. City College, Graduate School, *Washington, District of Columbia* 20001 (NSG 5003)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0010, COMMAND AND CONTROL - ADVANCED AUTOMATION RESEARCH--SEMANTIC MODELING AND INFORMATION SYSTEMS

R.T. CHIEN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (N00014-67-A-0305-0026)

The Navy has need for more advanced computer-based information systems--systems which could efficiently handle large scale and complicated data bases in a natural language form. This task is to develop techniques that are fundamental to the construction of next- generation intelligent information systems.

The approach is to develop flexible semantic models wherein the data base would exist in both static and dynamic form. The static information would generally exist in the form of lists and relational triples, while the dynamic information would be stored in terms of procedures. The system would invoke the precedures automatically for interpretation and efficient execution.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0011, NAVY VEHICLE DESIGN AND CONSTRUCTION - ADAPTIVE CONTROL OF COMPLEX SYSTEMS

R.E. GOODSON, Purdue University, School of Mechanical Engin., *Lafayette, Indiana* 47907 (N00014-67-A-0226-0012)

Improvement in the automatic control of large Navy systems such as vessels and power systems in a continuing goal. The scale of some systems, e.g., shipboard and station power plants, design of submarine hulls is so large that modelling or measuring is done only by the use of large computer programs for each portion of the problem. This research is intended to achieve method for the adaptive optimization of such designs or control of such systems.

The investigator will pursue research in optimization and parameter identification. In addition to continued work on drag minimization through shape manipulation, research will be initiated on real-time mini computer identification for control in man-machine systems.

Supporting agency address information: Office of Naval Research 432, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0012, COMMAND AND CONTROL - THEORY AND APPLICATION OF MATHEMATICAL METHODS FOR COMPUTER SCIENCE AND INFORMATION PROCESSING

R.H. OEHMKE, Univ. of Iowa, School of Arts, *Iowa City, Iowa* 52240 (N00014-68-A-0500)

The object of this program is to apply the theoretical principles and techniques of mathematics, linguistics, computer science and engineering to the problems of automata theory. The major topics include switching theory, algebraic automata theory, mathenatical questions of logical design, linguistics, (centering on natural and artificfal languages), and special purpose information retrieval and simulation languages. These efforts are directed toward Naval applications in intelligence, command and control, and man-machine interaction.

Of special interest is work in the theory of program languages and their classification and in automatic theorem proving.

Supporting agency address information: Office of Naval Research 432, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0013, COMMAND AND CONTROL - DISTRIBUTED OPERATING SYSTEM FOR COMPUTING NETWORK CONTROL

M. LAY, Univ. of Maryland, Computer Science Center, *College Park, Maryland* (N00014-67-A-0239-0032)

The Navy of the future will be shifting from single computer use to networks of computers for command and control systems. This task is investigating algorithms for optimum design of a distributed software operating system capable of supporting a variety of real time, time shared, and batch processes.

In past work, the principal investigator developed a philosophy of computer networking which considers the processing nodes (i.e., the individual computer) of the system to be independent, yet managed by a unifying line of control which does not reside in any one site, but is distributed throughout the network. The current approach will be a test implementation with a large computer and several minicomputers. Particular attention will be given to the capabilities of minicomputer virtual memories and their contribution to the network's processes.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0014, COMMAND AND CONTROL ONR/BOSTON TIME-SHARED COMPUTER FACILITY

R.L. SCHWARTZ, Dial Data Incorporated, *Newton, Massachusetts* 02158 (N00014-72-C-0002)

For effective administration of an ONR branch office and administration of a contract research program, the staff should be cognizant of modern data processing techniques. This task is to provide ONR/Boston, on an experimental basis, with time-shared computing services.

ONR scientists are testing the applicability and efficiency of a locally available time-shared computer by experimenting with both scientific and administrative type problems. One of these, a red blood- cell survival study, originated at the Chelsea Naval Hospital, and is being pursued jointly with an ONR scientist.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0015, COMMAND AND CONTROL - QUEUEING NETWORKS

R.L. DISNEY, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (N00014-67-A-0181-0047)

To improve the Navy's command and control capability by creating improved statistical and probabilistic methodolgy for modeling, evaluating and operating command and control systems.

To perform research on statistical and probabilistic methodology for queueing network problems, emphasizing decomposition switching rules; departure, recomposition, and feedback studies; and Markovian network studies.

Supporting agency address information: Office of Naval Research 436, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0016, COMMAND AND CONTROL - RESEARCH ON NEW FORMS OF HIGH SPEEDCOMPUTER CIRCUITRY FOR NAVAL SYSTEMS

D.A. RUDBERG, Montana State University, School of Engineering, *Bozeman, Montana* 59715 (N00014-67-C-0477)

The objective of this research is the logical design, simulation, and verification of a class of high speed, real-time cellular (array) computers for Naval systems. The Navy has need of new classes of computers for real-time processing to enhance the capabilities and efficiency of processing systems currently used for command and control, navigation, and guidance.

The approach to these problems usually involves matrix operations. When incorporated into the computer structure, it becomes desirable to use arrays of similar logic elements, interconnected to form a uniform pattern called 'cellular array logic.' This research effort explores the efficient organization of such a computer. It should be more capable of performing real time control of a larger number of input variables than can be controlled by present designs.

Supporting agency address information: Office of Naval Research 430C, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0017, NAVY VEHICLE DESIGN AND CONSTRUCTION - ENGINEERING STATISTICAL TECHNIQUES FOR PROCUREMENT INSPECTION
R. BECHHOFER, Cornell University, School of Engineering, *Ithaca, New York* 14850 (N00014-67-A-0077-0020)

The objective of this task is to improve Navy vehicle design and construction by performing research in Statistical Reliability Methodology in conformance to the provisions of SECNAVINST 3900.36 (reliability of Naval material). This task seeks to extend the field of reliability through development of appropriate techniques of mathematical statistics.

The contractor is performing research in mathematical statistics concerned with multiple-decision ranking procedures. These procedures and their related body of theory are of importance in making selection decisions based upon limited testing.

Supporting agency address information: Office of Naval Research 436, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0018, MATHEMATICAL SEMANTICS OF VERY HIGH LEVEL PROGRAMMING LANGUAGES
R.L. CONSTABLE, Cornell University, School of Engineering, *Ithaca, New York* 14850

This project will develop and study a simple theoretical model of a very high level programming language based on formal constructive mathematics augmented by an axiomatic formalism for algorithms. The goal of this research is two-fold: first, to apply recent ideas in semantics (i.e.new axioms for language features and concern for least fixed points) to a new level of language definition and second, to formulate precise technical problems important to semantic theory in such a way that these are accessible to a wide group of theorists (in particular to specialists in computational complexity, automata, formal languages and logic).

SUPPORTED BY U.S. Natl. Science Foundation

7.0019, COMMAND AND CONTROL - MATHEMATICAL MODELS FOR LARGE-SCALE COMBINATORIAL PROBLEMS IN RESOURCES ALLOCATION
D.R. FULKERSON, Cornell University, School of Engineering, *Ithaca, New York* 14850 (N00014-67-A-0077-0028)

This task provides mathematical support for handling a large class of practical problems arising in Naval command and control, systems design and information storage and retrieval contexts. The common characterization of such problems is their modelling in terms of networks or other combinatorial structures. Examples are the design and control of network flows of information; or of optimal design of command and control systems of interrelated components depending on various design parameters (such as utility functions, variable external inputs, etc.).

The approach to be used herein is to identify fundamental and crucial problems in the underlying combinatorial structures; to devise effective algorithms for the analysis of network flows; and as a highly significant extension, to devise new algorithms for general linear programming that are analogues to network flow algorithms.

Supporting agency address information: Office of Naval Research 432, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0020, COMMAND AND CONTROL - OPTIMIZATION OF MAN-MACHINE INTERACTION IN THE COMPUTER SOLUTION OF NAVAL PROBLEMS
N. PRYWES, Univ. of Pennsylvania, School of Electrical Engin., *Philadelphia, Pennsylvania* 19104 (N00014-67-A-0216-0014)

This task, related to Navy needs for both achieving efficient computers operation in a large file environment and communicating across geographically dispersed and non-standardized computer organizations, has the objective of creating software tools which respond to the described problems. Current major emphasis is to achieve automation of the programming function itself.

Related to his design of a data description language and processor to facilitate interchange across non-standardized hardware and software, contractor will design experiments and methodology to measure the effectiveness of the processor; the DDL processor, an automatic program generator for file conversion, will be compared on both a speed and error basis against man produced programs for achieving the same file conversion goals. The DDL processor will further be examined in terms of its capacity, with modifications, for contributing to the larger goal of automating the total programming function.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0021, COMMAND AND CONTROL - MATHEMATICAL MODELS FOR PLANNING AND CONTROL OF COMPLEX NAVY SYSTEMS
G. THOMPSON, Carnegie Mellon University, School of Industrial Admin., *Pittsburgh, Pennsylvania* 15213 (N00014-67-A-0314-0007)

This research is directed toward management of complex logistic and industrial-type activities through development of algorithms for mathematical programming. These techniques will help to insure efficient operation of Navy activities consistent with performance criteria.

Research will be continued on a wide range of programming topics. These include several topics in 0-1 integer programming, some non-convex problems with special structure, a study of variations of the 'transportation' problem applied to machine scheduling and warehouse location, and work on mathematical models of expanding economies.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0022, COMMAND AND CONTROL - TIME CONSTRAINED LOGISTIC DECISION MODELS
A. CHARNES, Univ. of Texas, School of Arts, *Austin, Texas* 78712 (N00014-67-A-0126-0009)

The research under this task is directly related to the planning and control of Navy logistic processes. Particular emphasis is based on problems related to manpower planning and allocation.

Work will center largely on optimization techniques for allocation problems and their variations. In addition, some research will be conducted on applications of the theory of stochastic processes to queueing, chance constrained games, and network problems where traversal times are random variables.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0023, INTEGER NONLINEAR OPTIMIZATION PROBLEMS AND THE DEVELOPMENT OF COMPUTATIONAL ALGORITHMS
H.W. LOOMIS, U.S. Navy, Weapons Laboratory, *Dahlgren, Virginia* 22448

Optimization problems involving integer-valued decision variables occur frequently in operations research and in systems analysis. The cost-effectiveness analyses performed within DOD are optimization problems of this type. These problems involve the optimization of a criterion function, subject to constraints, with the requirement that some decision variables be integers. Mathematical methods exist for solving this problem when the criterion and constraint functions are linear. The objective of this research is to develop methods of solution for nonlinear problems.

The mathematical method to be used in solving the integer nonlinear optimization problem is the branch-and-bound technique. Algorithms based on this technique will be implemented in the form of computer programs. An initial algorithm will be developed for a prototype problem, the integer concave problem, and this will then be extended to the more general integer nonlinear problem.

Supporting agency address information: Naval Weapons Lab., Dahlgren, Va. 22448.

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0024, NAVY VEHICLE DESIGN AND CONSTRUCTION - NONLINEAR EIGENVALUE PROBLEMS
P. RABINOWITZ, Univ. of Wisconsin, School of Natural Sciences, *Madison, Wisconsin* 53706 (N00014-67-A-0128-0024)

As the requirements for accuracy in naval systems increase it becomes necessary to use more realistic modelling procedures. Usually this means using nonlinear models rather than linear ones. The objective of this task will be to obtain techniques for solving or gaining insight into solutions of nonlinear partial differential equations.

The investigator will study nonlinear partial differential equations which characterize various physical systems and depend on some relevant physical parameter. The basic question of interest is in the structure of the set of solutions of these equations as a function of this parameter.

Supporting agency address information: Office of Naval Research, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL SOLID STATE PHYSICS
M.L. COHEN, Univ. of California, School of Letters, *Berkeley, California* 94720

Research previously supported under GH-35688 will be continued. A very broad program of theoretical research in semiconductors (both electrical and optical properties), superconductivity, magnetic materials, fine particles, amorphous solids, and the interactions of muons with crystals will be carried out. In calculations of the electronic properties of semiconductors and superconductors, the empirical pseudopotential method will be used.

SUPPORTED BY U.S. Natl. Science Foundation

8.0002, THEORETICAL RESEARCH ON THE ELECTRONIC PROPERTIES OF SOLIDS
L.M. FALICOV, Univ. of California, School of Letters, *Berkeley, California* 94720

Research previously supported under GH-34438 will be continued. Theoretical investigations will be made of those properties of solids and molecules which depend primarily on their electronic structure. Specific areas to be investigated will be: A. Electronic Properties of Transition-Metal and Rare Earth Compounds. B. Transport Properties of Ferromagnetic Metals. C. Electronic Propertis of Normal Metals and Semiconductors. D. Optical Properties of Solids. E. Electronic Properties of Surfaces. F. Electronic Properties of Molecules.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, EXPERIMENTS IN LOW TEMPERATURE PHYSICS
W.H. PARKER, Univ. of California, School of Physical Sciences, *Irvine, California* 92664

Several experiments at low temperature investigating properties of both superconducting and normal metals previously supported by NSF Grant No. GP-14240A1 will be continued. (1) Certain properties of non- equilibrium superconductors will be measured using tunnel junctions. These include a determination of the quasiparticle recombination time and the effective chemical potential of the non-equilibrium quasiparticles in several superconductors including Sn and Pb. The processes by which a high energy (1 ev) quasiparticle relaxes to the states just above the energy gap will also be investigated. (2) The quasiparticle-pair interference current, the so-called COSP term in the current through a Josephson Junction, will be investigated in both current biased weak links and in SQUIDs. (3) Using a new technique of measuring temperature dependent resistivities with significantly increased sensitivity, the low temperature behavior of the electrical resistivity of pure noble and alkali metals will be measured. (4) The development of large diameter SQUIDs for precision measurements on rotating superconductors and (5) the development of an ultra-stable tunnel diode oscillator as a frequency transducer for measurements of material properties at low temperature will be continued.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, THEORETICAL NUCLEAR PHYSICS
S.A. MOSZKOWSKI, Univ. of California, School of Letters, *Los Angeles, California* 90024

Research in theoretical nuclear physics initiated under NSF grant GP-35737X1 will continue. Specific topics to be investigated include: Dr. S. A. Moszkowski: 1. Equation of State of Neutron Star Matter; 2. Interaction Energies in Many-Body Systems; 3. The Local Density Approximation; 4. Comparison of Hartree-Fock and Droplet Models for Nuclei.

Dr. C. W. Wong: 1. Tensor Correlation and Coulomb Displacement Energies; 2. Diagrammatic and Landau Methods for Effective Interactions; 3. The Skyrme Expansion of the Effective Two-Nucleon Interaction; 4. Coupled-Channel Calculations in the Resonating Group Method; 5. Solution of the Resonating Group Wave Equation by Sasakawa Iterations; 6. Impulse Approximations in High Energy Reactions; 7. Nuclear Matter Calculations; 8. Generator Coordinate Methods in Nuclear Physics.

SUPPORTED BY U.S. Natl. Science Foundation

8.0005, NON-EQUILIBRIUM EFFECTS IN FAST MOVING PLASMAS
F. SCHWIRZKE, U.S. Navy, Postgraduate School, *Monterey, California* 93941

To investigate the absorption of laser radiation in a plasma and the generation of magnetic fields by nonaligned electron density and temperature gradients.

A high powered laser pulse is focused onto a target to produce a dense hot plasma. Plasma phenomena associated with the propagation of electromagnetic waves are investigated by measuring the absorption, scattering and reflection of the laser radiation as function of time and plasma density. The self, generated magnetic fields are measured with small probes as function of time, position and pressure.

Supporting agency address information: Office of Naval Research 473, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0006, PROPERTIES OF EXOTIC HIGHLY RELATIVISTIC ATOMIC SYSTEMS
M. SCHWARTZ, Stanford University, School of Humanities, *Palo Alto, California* 94305

The work to be performed consists of an ingenious experiment using K zero L mesons to measure the Lamb shift for pi-mu atoms to an accuracy of 1% and an ultimate accuracy of 0.1% in order to determine the radius of the pi meson. Other parts of the program include the following: 1. Search for mu minus proton and mu plus proton atoms from lambda zero and anti lambda zero decay respectively. 2. Measurement of the lifetime of the 2p states of the pi-mu atom. 3. Study of the ionization process on the above atoms as they traverse thin foils. 4. A measurement of the magnetic moment of the ground state of the pi-mu atom. 5. A measurement of the fine structure of the pi-mu atom.

SUPPORTED BY U.S. Natl. Science Foundation

8.0007, MECHANISMS OF DISPLACEMENT AND TRANSIENT EFFECTS
J.A. NABER, Gulf Energy & Environ. Sys. Co, *San Diego, California* 92112 (DAAG39-73-C-0197)

To determine the displacement effects which produce permanent damage in electronic materials and to correlate the observed damage with the type of radiation exposure. Establishment of a correlation between transient radiation effects and the ionization energy deposited in materials by pulses of various types of radiation.

Displacement effects in electronic materials are investigated by utilizing linac and triga reactor as pulse generation instruments. Displacement effects radiation damage is correlated with the type of radiation exposure and annealing properties. Effects of permanent damage on the operational characteristics of various electronic materials will also be investigated. A correlation will be established between radiation, ionization energy deposition and electron production in materials to determine transient effects without the use of a X-ray source.

Supporting agency address information: AMC HDL Systems Research Laboratory, Branch, (AMXDO-RCE) Semiconductor and Radiation Effects Physics, Washington, D.C. 20438.

SUPPORTED BY U.S. Dept. of Defense - Army

8.0008, INVESTIGATIONS IN THEORETICAL SOLID STATE PHYSICS

H.B. SHORE, Univ. of California, Graduate School, *San Diego, California* 92038

Theoretical investigations in several areas of solid state physics previously supported under GH-34439 will be continued: 1. Work on the defect-phonon interaction in paraelectric systems will be extended. Accurate shell model calculations of lattice phonon spectra will be utilized in calculating the renormalization factors for tunneling parameters of (100), (110) and (111) oriented impurities in all the alkali-halides. Work on a microscopic calculation of the impurity- lattice potential for the experimentally interesting systems Ag:RbBr, Ag:RbCl will be begun by including lattice relaxation effects properly. It is hoped to explain the (110) orientation of these systems. 2. The surface properties of the electron hole liquid will be studied. The surface energy and dipole layer will be calculated using the Kohn-Sham method of an effective single-particle Schroedinger equation. An attempt will be made to develop a time dependent version of this method to study surface excitations of the liquid. 3. The theory of stochastic processes will be applied to several practical problems in the analysis of data obtained from fluctuation-spectroscopy experiments. The aim is to develop convenient and inexpensive.methods for experimental applications.

SUPPORTED BY U.S. Natl. Science Foundation

8.0009, LIGHT SCATTERING STUDIES OF CRITICAL AND BIOLOGICAL SYSTEMS

D.S. CANNELL, Univ. of California, School of Letters, *Santa Barbara, California* 93106

A study of the fundamental static and dynamic properties of substances in the vicinity of phase transitions, and to develop a technique for the detection of conformational changes in biological macromolecules supported by NSF GH-34420 will be extended. First, an accurate technique for measurement of the long range correlation length in pure fluids developed in this laboratory will be used on Xenon both above and below the critical temperature Tc. This technique will also be adapted for use in a solid, NH4Cl. Second, in order to study the dynamic behavior of critical systems an acoustic beam probing apparatus capable of making very accurate sound speed and attenuation measurements in the frequency range of a few megahertz to several hundred megahertz has been constructed. Such measurements are being made on SF6 both above and below Tc and analyzed in terms of mode-mode coupling theories. These measurements will be completed and similar measurements will be made in Xenon. Third, a method for making accurate measurements of the thermal diffusivity of solids while maintaining the sample isothermal to within 10 m degrees C has been developed. This technique will be used to study CoO in the vicinity of its anti-ferromagnetic phase transition. Fourth, a temperature controller which maintains a 1.3 liter volume constant in temperature to within plus or minus 15 degrees C has been constructed. This instrument will be used to make extremely accurate heat capacity measurements, in the vicinity of the smectic-A to nematic phase transition of a liquid crystal to determine whether it is first or second order. Fifth, measurements of the pressure-area isotherms of a monomolecular layer of hydrocarbon molecules spread on a water substrate will be continued. Sixth, a technique for measuring directly, very small changes in the translational diffusion constants of biological macromolecules while in solution will be developed.

SUPPORTED BY U.S. Natl. Science Foundation

8.0010, ATOMIC TIME STANDARDS

D.W. ALLAN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302

Our objective is to generate, and to make available the second, one of the base units of System International, by generating time scales based upon it. Time measurement is directly or indirectly required for many of the measurements upon which our industrial economy depends. This project makes a basic contribution toward meeting that need, and the statutory responsibilities of NBS. It utilizes an ensemble of commercially produced cesium clocks, calibrated by NBS primary frequency standards, with its output statistically processed for optimum stability and accuracy.

Objective: One of the seven base units in the System International (SI) is the second. Our continuing objectives are: A. To generate continuously, to improve, and to make available this base unit along with a time scale based upon it, AT(NBS), with the best accuracy, stability, and reliability reasonably achievable; B. To provide an internationally coordinated time scale, UTC(NBS) also based on the SI second; --which scale is the time reference for the vast majority of civilian users, and C. To study and to make available the results of these studies on how to optimally utilize atomic clocks.

Motivation: A. To meet statutory responsibilities of NBS. B. To insure comparability of many types of measurements made at different times and places, many types of measurements depending either directly or indirectly upon the basic measurement of our complex industrial economy, and to the advance of the scientific understanding upon which that economy is based. C. To insure the international comparability of measurements which is needed to permit international trade in industrial products. D. To meet various traditional needs such as the control of multiplexed communications and the need for navigational signals.

Approach: To utilize optimally data obtained from an ensemble of commercially available cesium clocks, and occasional frequency calibrations by an NBS primary frequency standard to generate an accurate and uniform time scale. Redundancy and automation are used in the clocks, power sources and data recording equipment, and digital computers are used to process the data and to monitor the operation. Time scale algorithms are developed utilizing optimum filtering techniques along with state-of-the-art statistical data processing technique. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0011, ELECTROCALORIC/MILLIKELVIN RESEARCH

J.D. SIEGWARTH, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302

This project deals with two main areas (1) that of improving the usefulness of the millikelvin temperature range and (2) the development of electrocaloric refrigeration for the range between 15 degrees K and 4 degrees K, in support of the development of superconducting machinery. The Kapitza thermal boundary resistance is particularly troublesome in experiments and thermometry at temperatures below 1 K, yet it is not very well understood. Therefore particular emphasis is being placed on a better understanding of Kapitza resistance. The development of the electrocaloric refrigerator requires measurements of the electric and thermal properties of glass-ceramics and studies of heat switches.

Objectives: The overall objective of this project is to improve techniques for obtaining and utilizing temperatures below 1 K and to establish the technology of electrocaloric refrigeration at 4 K. Some specific current objectives are (a) to better understand thermal boundary resistances (Kapitza resistance); (b) to increase the efficiency of heat exchangers at temperatures below 1 K; (c) to explore the properties of polar dielectrics below a temperature of 1 K; (d) to develop a prototype electrocaloric refrigerator operating between 4 K and 15 K.

Motivation: A considerable amount of research is now being done below 1 K, primarily at universities, and several significant findings in the behavior of metals, He3, and polar dielectrics have occurred. However, many problems inherent in working at these temperatures need to be overcome to enhance the transfer of laboratory results to the technological marketplace. Of particular

concern to NBS are the thermometry problems caused by high Kapitza resistances. The poor reliability of refrigerators even for 4 K is the motivation for studying the solid state electrocaloric refrigerator in the 4-15 K temperature range. The technologically important superconductors must operate near 4 K.

Approach: We are studying the Kapitza resistance between dilute He3-He4 solutions and a few pure metals and alloys with different surface preparations and heat treatments, both in bulk and fine powder form, as a means of enhancing heat transfer and of separating responsible heat transfer mechanisms. We are studying the dielectric constant, specific heat, thermal conductivity and the electrocaloric coefficient of several glass-ceramics and some other polar dielectrics as a function of electric field. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0012, TRAPPED ION COLLISION STUDIES - RECOMBINATION

G.H. DUNN, Univ. of Colorado, School of Arts, *Boulder, Colorado* 80304

This grant supports the study of dissociative recombination of electrons and molecular ions which enters prominently into the control of ionization balance and particle chemistry in the ionized layers of planetary atmospheres. Despite the accumulation over a period of years of a sizeable body of reliable data on dissociative recombination of electrons with ions, there is still a substantial data need extending our knowledge to other species, greater energy range, and known internal energy states of common species.

This grant continues research on the trapped ion method for obtaining recombination data which strongly complements the afterglow method; application will be made to a number of new ions, and several selected ion species will be irradiated with a tuneable infrared laser bake study.

SUPPORTED BY U.S. Natl. Science Foundation

8.0013, STRUCTURAL PHASE TRANSITIONS IN MOLECULAR CRYSTALS AND FERROELECTRICS

N.S. GILLIS, Colorado State University, School of Science, *Fort Collins, Colorado* 80521

Research supported by NSF Grant GH-35581 will be continued and expanded. Work on the structural phase transitions in diatomic molecular crystals will be continued. The equation of state and the phonon spectra of solid H2 and D2 will be investigated. Work to determine the intermolecular potentials and their effect on the structural phase transformation for N2 and CO will be undertaken. New work on the structural phase transition in the hydrogen halides will be undertaken. The temperature dependence of the libron and phonon frequencies in HCl, DCl, HBr, and DBr will be calculated, and a description of the transition region will be developed. The structural phase transitions in the BaMF4 like materials will be researched. New self-consistent approximation schemes for calculations concerning ferroelectrics will also be developed.

SUPPORTED BY U.S. Natl. Science Foundation

8.0014, HEAT PULSE STUDIES IN SOLIDS

J.U. TREFNY, Wesleyan University, Graduate School, *Middletown, Connecticut* 06457

Experimental investigations being carrid out under support of NSF Grant No. GH-32244 will be continued and extended. The aims of the program are: 1. Development of improved instrumentation, particularly the utilization of monochromatic phonon generators. 2. Ballistic pulses in Solid He4. 3. Studies of the body centered cubic phase of He3, including temperatures low enough to decouple the lattice and exchange systems. 4. Measurement of the specific heat of thin metallic films near the superconducting transition. 5. Studies of He3-He4 mixtures.

SUPPORTED BY U.S. Natl. Science Foundation

8.0015, SOLID STATE PROPERTIES OF METALS VIA TUNNELING INTO BULK SINGLE CRYSTAL SUPERCONDUCTORS - INTEGRATED THEORETICAL & EXPERIMENTAL INVESTIGATION

W.L. CLINTON, Georgetown University, School of Arts, *Washington, District of Columbia* 20007

An integrated experimental and theoretical study of tunneling into bulk single-crystal superconductors supported by NSF Grant GH-34663 wll be continued. A consistent set of exprimental data has been obtained and an accompanying theoretical analysis have allowed the determination of the nearly-free-electron (NFE) Fermi sphere radius and and crystal pseudopotential for a weak-coupling superconductor from bulk single- crystal tunneling data. Thus far the work has concentrated on Ga, although a substantial beginning has been achieved with In and Al. The particular results for Ga are in good agreement with the experimental estimates of the effective free electron sphere radius and the pseudopotential calculations for that material. These results represent the first evidence that tunneling data on bulk, single-crystal, weak- coupling superconductors can be employed to probe the normal state electronic properties as well as the usual superconducting state properties. If these results continue to be verified in further research, the product will be a technique which will make possible a substantial increase in our knowledge of real metal properties and our understanding of the mechanisms responsible for superconductivity.

SUPPORTED BY U.S. Natl. Science Foundation

8.0016, SPACE CHARGE EFFECTS IN SEMICONDUCTORS

A.L. WARD, U.S. Army, Harry Diamond Labs., *Washington, District of Columbia* 20310

The technical objective is the understanding of the transient behavior of space charge in semiconductor devices. An existing computer program is used which permits the simulation of two-terminal devices. The principal emphasis is on Gunn oscillators and avalanche devices.

The computer program is used to solve the non-linear transport equation with space-charge limitation. Pulse transport, including recombination and diffusion, is studied as a function of doping level and applied field. Gunn oscillations are studied for a specific variation of drift velocity with electric field. Electrical breakdown and avalanche oscillations are studied for arbitrary junction profiles in semiconductors. Calculations are guided by comparison with experimental measurements made in these laboratories and elsewhere.

Supporting agency address information: AMC Harry Diamond Labs, Washington, D.C. 20438.

SUPPORTED BY U.S. Dept. of Defense - Army

8.0017, CRYOGENIC THEORY

P.H. MEIJER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The work of this project, which is theoretical in nature, is carried out in coordination with part of the experimental program in Project 2213135. The theoretical studies involve the characterization of the thermodynamic properties of magnetic systems with the goal of obtaining systems which can be described as ideal paramagnets. Ideal paramagnets are potentially of great use for 2213135.

This project also involves a study of thermal contact problems, particularly as they relate to very low temperature.

Objective: (a) Calculate the temperature dependence of the entropy and susceptibility of materials containing magnetic spins. (b) Calculate the 'Kapitza resistance' - the thermal impedence between two bodies in physical contact - for interfaces of interest to Project 2213135.

Motivation: The NBS effort to establish a more accurate temperature scale below 20 degrees K (see NBS Project Report for Cryothermometry: 2213135) will be aided by the development of an ideal paramagnetic thermometer for temperature interpolation. The material CMN is quite satisfactory between 0.01 degree K to 2.0 degrees K. Part of the study to examine the reasons for its departure from ideal paramagnetism below 0.01 degree K. At temperatures above 2 degrees K other salts will be studied.

Intimately related to the use of a thermometer is the certification that the thermometer is in good thermal contact with the

experiment. For this reason, a theoretical study of Kapitza resistance will be made.

Approach: (a) Large scale computer calculations are used to calculate the entropy and susceptibility of magnetic materials. Input parameters used are the g-factors, lattice constants, spin-spin coupling, and crystal field parameters which are determined by an independent set of measurements. Using a standard statistical mechanical framework, the following conclusions are reached for a given candidate: its Weiss delta, deviations from ideal paramagnetism, ground state energy, and ordering temperature. The location of these ordering temperatures are of major importance since they determine the lower limit of usefulness of a particular paramagnet. (b) Calculation of Kapitza resistance requires a characterization of the acoustic behavior of several boundaries-somewhat similar to geometric optics.

A complete and the first quantum mechanical calculation of the ground state (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0018, QUANTUM THEORY MOLE SCATTERING

F.H. MIES, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

This project is concerned primarily with the calculation of accurate molecular wave-functions for diatomic molecules. Principally we use the theory of close-coupling to calculate various properties of molecules. Quantum mechanical close-coupling calculations involved the accurate numerical determination of the vibrational-rotational wave- functions of a molecule, given a set of molecular electronic states, and various coupling matrix elements between these states. Such calculations for bound states can yield very accurate energy levels and radiative lifetimes. Similar calculations for dissociated states yield scattering wave functions which determine quenching and energy transfer cross-sections, and the branching ratios for the atomic fragments in photo dissociation and predissociation.

Objective: The general objective is to develop the theory and produce numerical procedures which can utilize accurate molecular electronic wavefunctions to obtain observable molecular properties such as atomic scattering cross-sections, photodissociation cross-sections, molecular energy levels, and radiation lifetimes. Specifically we are currently developing a general numerical close-coupling program which can be applied to this broad range of problems.

Motivation: The ultimate motivation is to obtain molecular properties which are either difficult or impossible to obtain in the laboratory and which aid in the interpretation or analysis of various experimental programs. Specific quenching and photodissociation cross- sections, and the general theory of radiative processes are of direct interest to Laser Fusion Program in the AEG. Calculations of molecular infrared radiative processes are being applied to the interpretation of atmospheric phenomena of interest to the Air Force. The fluorescent pumping rate of molecule energy levels and various energy transfer processes are of concern in the interpretation of planetary, cometary, and interstellar phenomena at NASA.

Approach: General close-coupling techniques as applied to specific problems which can be compared to experimental data and serve as a calibration of the accuracy to be obtained and improvements that are required in our theoretical analysis.

Progress: During the past year a general theoretical analysis of close- coupling effects in the spectra of electronically degenerate molecules has been carried out, and applied to a calculation of the vibrational-rotational radiative transitions. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0019, ELECTRON INTERACTIONS IN SOLIDS

C.J. POWELL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Parameters describing the interaction of low-energy electrons in solids need to be known for two common techniques of surface analysis and in radiation biology. Measurements are now being made of the mean free paths for inelastic scattering in solids at low energies (up to 2000 EV) using either a direct transmission method or a technique based on the yield of proton-excited Auger electrons. Auger-electron lineshapes are measured with improved energy resolution to give information on chemical environment.

Objective: To determine key parameters, describing the interaction of low-energy electrons with solids, that are required in both electron- spectroscopic methods of surface analysis and in radiation biology. (A) The most important single parameter required now is the electron attenuation length as a function of material and electron energy (in the range 50 to 2000 EV). (B) Lineshape data is required for Auger-electron transitions in representative materials. (C) Electron energy-loss data for biologically relevant materials such as ice and simple solid hydrocarbons need to be measured at low incident electron energies.

Motivation: Two relatively new techniques, Auger-electron spectroscopy and X-ray photoelectron spectroscopy, are being used at an increasing rate for qualitative surface analysis and there is a considerable demand (from users and manufacturers) for quantitative analyses of surfaces by these methods. The sensitivity of these techniques to surfaces is due to the short mean free path for inelastic scattering of Auger electrons and photoelectrons. The mean free path, a function of material and of electron energy, needs to be known for relative or absolute surface analyses. Mean free path data is also required by the AEC for their radiological physics program. All forms of ionizing radiation produce cascades of low-energy secondary electrons that are ultimately responsible for most tissue damage; the nature of energy transfer and energy deposition needs to be known for proper dosimetry and therapy. We hope to measure electron mean free paths in hydrocarbon materials but we initially need to measure electron energy- loss spectra in these materials to determine the energy loss modes at low energies and to determine the nature and rate of electron bombardment damage. Finally, we need to measure lineshapes of Auger- electron transitions involving valence electrons. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0020, NEUTRON SOLID-STATE PHYSICS

J.M. ROWE, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

The neutron spectrometer facilities of the NBS reactor are used to determine the structure, dynamics and related properties of materials of importance in Science and Technology. Current major objectives and progress include the determination of the microscopic effects of interstitial hydrogen in transition metals (which are related to several important technological areas) and the application and improvement of neutron scattering techniques to study the structure and phase transitions in prototype 'molecular' materials. The development of new instrumentation and analytical techniques to maintain state-of-the-art measurement capability is a further objective of the Neutron Solid State Physics Section.

Objective: To determine the structure and related properties of materials important in science and technology, utilizing the neutron beam facilities at the NBS reactor. Currently our major goals involve the determination of the microscopic effects of interstitial hydrogen isotopes in transition metals and the development of improved measurements and methods of analysis to provide more detailed information on the structure and dynamics of complex solids.

Motivation: The reactor beam facilities provide a national resource for materials characterization which is unique in the Washington area and in fact in the entire Middle Atlantic region. The neutron has unusual characteristics as a materials structure probe (for the study of metallic, inorganic and molecular materials, magnetic solids, and liquids), which provide an important capability to NBS in its role in the characterization of materials and the development of materials-measurement techniques. For example, we are involved in continuing studies of the phenomena of microscopic diffusion and structure effects of hydrogen isotopes in metals (such as refractory metals) which are of direct importance in such potential energy sources as nuclear fusion reactors and metal-hydrogen fuel storage systems. Our cooperative programs with in-house other-agency groups, such as NOL, NRL, and Picatinny Arsenal (described in NBS 228 forms for cost center Nos. 3140400, 3140404 and 3140406) provide important information on the properties of magnetic and energetic materials

which are widely used in civilian and military applications. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0021, TRANSITION PROBABILITIES
W.L. WIESE, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Atomic transition probabilities and plasma line broadening parameters are determined experimentally and theoretically with a variety of techniques, each best suited to the particular situation at hand. The data to be determined are chosen according to the most important needs of the technological and scientific community. Currently, a large part of our work is in response to urgent needs in the National Thermonuclear Fusion Program and other data needs for the general improvement of plasma analysis techniques.

Objective: The objective of this work is the experimental and theoretical determination of important atomic transition probabilities and plasma line broadening (Stark) parameters.

Motivation: These quantities are needed in a wide variety of fundamental studies of plasma behavior and are also needed for the accurate diagnosis of hot plasmas (determination of temperature, charged particle densities, element concentrations). Currently, data for highly ionized heavy elements are of crucial importance to understand and solve the impurity problems which plague thermonuclear fusion plasmas, causing drastic cooling by radiation and plasma instabilities.

Approach: We have started, in close contact with AEG fusion laboratories, to make theoretical studies of these needed atomic parameters. Our approach is either to extend well-proven theoretical techniques (which we have used for years) to highly ionized spectra, now accounting for relativistic effects or, secondly, to utilize systematic trends in isoelectronic sequences. We have also underway experimental emission measurements with high temperature stabilized arcs and pulsed plasma sources (Z-pinch) to provide basic data for general plasma diagnostics and will attempt to extend these to higher ions.

Progress (Prior FY): During the last fiscal year, we finished calculations for the neutral and ionized aluminum spectrum and completed measurements for neutral iron and neutral and singly ionized titanium. Further experimental work is in progress on transition probabilities of silver and uranium and plasma line broadening parameters of phosphorus and hydrogen. The hydrogen line broadening measurements are of a very fundamental character and are also supported by parallel theoretical work. Both studies have in this case the primary objective of advancing plasma line broadening to the point where it can be used as a high precision plasma. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0022, KOSSEL LINE STUDIES
H. YAKOWITZ, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234

Techniques of scanning electron microscopy, electron probe microanalysis, optical microscopy, electron channelling and x-ray microdiffraction among others are applied in order to solve problems relating to phase interactions, internal strains, magnetic structure and phase identification in a variety of materials. The project is currently involved in the study of composite materials, Monte Carlo methods for electron channelling data and the development of a magnification standard for scanning electron microscopy.

Objectives: In FY-75, correlation of electron channelling patterns from the scanning electron microscope (SEM) with impressed strains will be completed. The application of Monte Carlo methods to the solution of special problems in electron probe micro-analysis will be completed. A general objective is to improve the methodology of microanalysis and the SEM.

Motivation: The ability to map stress-strain distributions may provide new approaches to understanding the phenomena of crack propagation in metals, bonding between matrix and reinforcer in composite materials and fracture mechanics. The Monte Carlo work will provide a means to obtain quantitative electron microanalysis from previously intractable cases such as small pollution particles, wear particles, inclusions, fibers-either free standing or in a matrix-and thin films on a substrate. The magnification standard effort is directly related to the NBS-SRM program.

Approach: Latest equipment for improved metallographic information transfer is used to solve a variety of problems involving SRM's pollution and failure analysis among others. New methods are developed as necessary.

Progress: Work on magnetic contrast in the SEM was brought to a stopping point and the results reported. This work is now marking time in hope of support through Energy Program funds. Monte Carlo programs for mciroanalysis were extended, in cooperation with 310.02, to include cylindrical and spherical shapes. The programs are now being applied to the analysis of wear particles (A.W. Ruff, 3120130). Composite materials consisting of various reinforcing materials in an aluminum matrix were characterized under a NASA sponsored program. We concluded that Al2O3 in Al offered the most promise for a satisfactory material. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0023, LIQUID CRYSTAL WAVEGUIDES
W.K. BURNS, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

(a) Study experimentally and theoretically waveguiding characteristics of smectic, and nematic liquid crystal waveguides. (b) Develop active waveguide devices in liquid crystal waveguides using molecular reorientation, and dynamic scattering. (c) Study anisotropic waveguides formed by frozen liquid crystals. (d) Study microscopic properties of liquid crystals. The Navy has a continuing need for optical devices and systems with emphasis on efficiency, size, weight, and versatility. These characteristics are features of microoptics.

Using thin films of appropriately aligned liquid crystals, optical waveguides will be fabricated and characterized with regard to degree of molecular alignment and propagation characteristics. By applying electric, magnetic, or acoustic stimuli, modulators, output/input couplers and mode switches will be fabricated. Aligned liquid crystals will be frozen and thin film anisotropic waveguides will be formed and characterized. With the waveguide techniques to be developed, the degree of molecular alignment and liquid crystal coherence effects will be studied.

Supporting agency address information: Office of Naval Research, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0024, OPTICAL MICROCIRCUITRY
T.G. GIALLORENZI, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

(a) To fabricate optical waveguides and investigate mode propagation properties. (b) To investigate both theoretically and experimentally acousto-optic, electro-optic, and nonlinear parametric processes in optical waveguides. (c) To investigate possible thin film waveguide light sources. The Navy has a continuing need for optical devices and systems with emphasis on efficiency, size, weight, and versatility. These characteristics are features of microoptics.

(a) Use sputtering techniques to prepare amorphous optical waveguides. (b) Use ion bombardment and ion diffusion to produce continuous profile waveguides. (c) Use liquid epitaxy to produce single crystal semiconductor waveguides. (d) Investigate nonlinear interactions in nonlinear single crystal substrates using amorphous waveguides on their surface. (e) Use surface acoustic waves to investigate interactions involving phonons and photons for filters, modulator devices and input- output couplers. (f) Use liquid crystals to fabricate active guides.

Supporting agency address information: Naval Research Laboratory (5500), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0025, CHARGED PARTICLE BEAM EFFECTS ON MATTER - THEORY OF PENETRATION BY HEAVY IONS
I. MANNING, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

The objective is to develop a quantitative theoretical understanding of the damage produced by fast heavy ions in reactor materials. This is a basic theoretical aspect of a program aimed at simulating neutron damage in high flux reactors.

A transport theory approach, using a Boltzmann type equation, is being applied. Numerical techniques using modern high speed digital computers will be used to solve this equation.

Supporting agency address information: Office of Naval Research (422), 800 N. Quincy Street, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0026, CUSP PLASMA PREHEATING EXPERIMENT
A.E. ROBSON, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390

The objective is to perform research on the creation of a plasma in cusp geometry suitable for compression by megagauss fields in linus for effects simulators, and development of pulsed power technology.

A large (one meter diameter) magnetic bottle is created by two oppositely directed magnetic coils (the cusp geometry). A lasma is created by a carbon dioxide laser and its properties studied.

Supporting agency address information: Naval Research Laboratory (7700), Washington, D.C. 20375.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0027, A STUDY FOR A HEAVY ATOM TRACER METHOD FOR THE MEASUREMENT OF TURBULENCE IN PLASMAS
J.M. TURNER, Morehouse College, Graduate School, *Atlanta, Georgia* 30314 (NSG 8020)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

8.0028, HIGH ENERGY PHYSICS RESEARCH
H.L. ANDERSON, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637

This program of research in strong and electromagnetic processes consists of two parts: 1. Study of inelastic micron p and micron n scattering in the few hundred GeV range. This experiment being performed at the Fermi National Accelerator Laboratory in collaboration with groups from Harvard and Oxford Universities will check the concept of scaling and answer questions on the parton model, fragmentation model and vector dominance model. 2. Search for a breadkdown in parity conservation in the strong interactions. This experiment, being performed in collaboration with groups from the University of Illinois and Los Alamos Laboratory will use the longitudinally polarized proton beam from the Argonne ZGS to measure the helicity dependence of the total cross section in p -nucleus scattering in the energy range of 5 to 12 GeV.

This work is a continuation of that currently supported by Foundation grant number GP-29973, amendment number two.

SUPPORTED BY U.S. Natl. Science Foundation

8.0029, GRAVITATIONAL PHYSICS AND RELATIVISTIC ASTROPHYSICS
S. CHANDRASEKHAR, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637

Research on a broad range of topics in theoretical relativity and relativistic astrophysics which was initiated under NSF grant GP-34721X2 will continue. Specific topics of investigation will include: 1. variational algorithm for normal modes of black holes (Chandrasekhar); 2. stability of stationary solutions (Geroch); 3. positive-energy conjecture (Geroch); 4. asymptotic structure at spatial and null infinity (Geroch); 5. nonradial pulsations of stellar models (Ipser); 6. fully relativistic, differentially rotating neutron stars (Ipser).

SUPPORTED BY U.S. Natl. Science Foundation

8.0030, HIGH ENERGY PHYSICS
J.W. CRONIN, Univ. of Chicago, School of Physical Sciences, *Chicago, Illinois* 60637

The program being conducted is varied and deals with some of the most current problems in the field of elementary particle physics. The experiments include: 1. Measurement of particle production (proton, pion, kaon, antiproton, and muon) in pp and p-nucleus collisions between 200 and 400 GeV/c. The data shed light on the nature of the protons structure and constituency. 2. Search for muon pairs in pp collisons. This experiment should be capable of answering the question of the possibility of muon production from other than pi and muon decay such as from the decay of intermediate bosons. 3. Measurement of particle production with high transverse momenta in high energy pi-p and pi-d collisions. This experiment should elucidate the observations made on such production in pp collisions and give further information on particle structure. 4. Search and possible measurement of the decay neutral Kl yields positive muon negative muon. This experiment should be capable of resolving an apparent discrepancy as to the existence of the process and answer what may be a theoretically misunderstood phenomenon.

This work is a continuation of that currently supported by Foundation grant number GP-29586, amendment number three.

SUPPORTED BY U.S. Natl. Science Foundation

8.0031, KAON EXPERIMENTS AND FURTHER STUDIES OF MUONIUM
V.L. TELEGDI, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637

This program consists of two main and distinct parts: 1. Study of the regeneration of neutral Ks mesons by the interaction of neutral KL mesons with carbon and hydrogen. This experiment, being performed at the Fermi National Laboratory, seeks to measure the difference between neutral Ks and neutral Kl cross sections in the few hundred GeV range to test the Paeeranchuk theorem. 2. Precision determination of the magnetic moment of the muon meson. This experiment, to be performed at the Space Radiation Effects Laboratory or the Columbia Nevis Laboratory, measures the r.f. transitions for muonium in a high magnetic field. Accurate information on the muon magnetic moment is important as a sensitive test of the validity of quantum electrodynamics and of muon- electron universality.

This work is a continuation of that currently supported by Foundation grant number GMPS7103120A04.

SUPPORTED BY U.S. Natl. Science Foundation

8.0032, MOSSBAUER AND DIFFUSION STUDIES IN SOLIDS
J.G. MULLEN, Purdue University, School of Science, *Lafayette, Indiana* 47907

The high temperature studies of the Mossbauer effect in cobaltous oxide, iron stabilized in the BCC phase by means of doping with V,Mo, and Si, and NaF and LiF funded under NSF Grant GH-33005 will be continued. We have already seen diffusion broadening in CoO, as well as making a new observation of relaxation phenomena between charge states, originally predicted by Blume and coworkers. Our results on Fe:3 percent V are nearly complete and agree in essence with our earlier findings in metallic and oxide systems. Considerable data on the precipitation and association of Fe defects in LiF and NaF have been found, and crystal orientation effects in diffusion broadening are being explored for these systems.

SUPPORTED BY U.S. Natl. Science Foundation

8.0033, MAGNETOSTRICTIVE MATERIALS
A.E. CLARK, U.S. Navy, Applied Physics Department, *Silver Spring, Maryland* 20910

Utilize the huge magnetostrictive property available in heavy rare earth elements to develop a rugged durable transducer material with sufficient power capability to replace the fragile electrostrictive devices now widely employed in sonar fire control and surveillance systems.

To investigate the magnetostrictive, magnetic and elastic properties of rare earth-transition metals of the form (RxT, 1-x) where R is an element between Ce and Yb, and T Is Fe, Ni and Co. The investigation will be made on suspensions prepared by rapid sputtering technique on single crystals of the intermetallic compounds, and on cast samples prepared by ARC-melting. The system with the most promising magnetic, magnetostrictive and elastic properties will be determined.

Supporting agency address information: Office of Naval Research, Department of the Navy, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0034, PHYSICS OF NUCLEAR RADIATIONS
D.G. SIMONS, U.S. Navy, Physics Research Department, *Silver Spring, Maryland* 20910

The objective of the Nuclear Radiations Program is research into nuclear and atomic processes and into radiation and its interaction with matter. The experimental and theoretical efforts of the research are broad and relate to the physical problems associated with the origin and effects of all forms of nuclear radiation. The results of the research find application to Nuclear Weapon Systems and Weapon Effects as well as to systems and effects that are not weapons oriented.

To determine and apply basic principles of physics to the understanding of problem areas relating to the physical effects of all forms of nuclear radiation. Both theoretical and experimental research is performed. A portion of the experimental work is carried out through the use of a Van de Graaff accelerator as a source of positive ions.

Supporting agency address information: Naval Ordnance Laboratory Commander (CODE 00), Silver Spring, Md. 20910.

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0035, ITINERANT FERROMAGNETS ABOVE CURIE TEMPERATURE
S. ENGELSBERG, Univ. of Massachusetts, School of Arts, *Amherst, Massachusetts* 01002

A study to understand the properties of itinerant ferromagnets above their Curie temperatures supported by NSF Grant No. GH-34504 will be continued. Recent neutron scattering studies have observed a number of vestiges of the ferromagnetic state in the paramagnetic regime. The most striking is the persistence of the Stoner splitting of the spin bands.

This problem also leads naturally to an examination of the vertex corrections in the susceptibility. These corrections should eliminate the paramagnetic continuum band which would strongly damp the magnons in both the ferromagnetic and paramagnetic states.

SUPPORTED BY U.S. Natl. Science Foundation

8.0036, MATHEMATICAL PHYSICS
A.M. JAFFE, Harvard University, School of Arts, *Cambridge, Massachusetts* 02138

Study of the mathematical foundations of quantum field theory, previously supported by Grant GP-31239X1, X2, will continue. Research will deal with constructive field theory, axiomatic field theory, and connections with statistical mechanics.

SUPPORTED BY U.S. Natl. Science Foundation

8.0037, ELECTRONS IN COMPLEX SOLIDS
D.J. SELLMYER, Univ. of Nebraska, School of Arts, *Lincoln, Nebraska* 68508

The investigation of electronic and magnetic states in relatively complex solids supported by NSF Grant GH-35690 will be continued. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied: (1) complex ordered solids; (2) spin-polarized electron states in metallic compounds; (3) localized magnetic-impurity states in dilute alloys; and (4) electronic and magnetic states of clusters.

The experimental work will consist of de Haas-van Alphen measurements, in fields up to approximately 100 kG, in a superconducting solenoid, and high-field magnetoresistance measurements on selected compounds. In systems where localized magnetic moments or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed.

The results should contribute to our understanding of (1) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (2) the localized- moment and itinerant-electron aspects of magnetism in conducting solids, (3) the nature of localized-moment formation and magnetic interactions in complex (not nearly-free-electron) metals, and (4) the dependence of the electronic and magnetic structure of pairs or larger impurity clusters on local-environment and structural effects.

SUPPORTED BY U.S. Natl. Science Foundation

8.0038, THEORETICAL SOLID STATE PHYSICS - OPTICS, AND GROUP THEORY APPLICATIONS
J.L. BIRMAN, New York University, School of Arts, *New York, New York* 10003

Research supported by NSF Grant No. GH-031742 on optical properties of solids will be continued. The thrusts will be on: (1) spatial dispersion effects in insulators near the excitonic absorption, (2) resonant light scattering due to excitons. The effect of stacking faults, electron-hole drops and Bose condensation of excitons will also be investgated.

Group Theory Applications to Solid State Physics will be considered. The theory of crystal Clebsch-Gordon Coefficients will be researched. Liquid crystals and phase transitons will be a topic of work utilizing Continuous Symmetry Groups.

SUPPORTED BY U.S. Natl. Science Foundation

8.0039, QUANTUM FIELD THEORY AND STATISTICAL MECHANICS
J. GLIMM, New York University, School of Arts, *New York, New York* 10003

This continues research previously funded under NSF GP-24003A3 to New York University.

There will be an investigation of quantum field models in two and three space time dimensions, with a particular emphasis on problems such as nonperturbative renormalization, which are important for four dimensions. In doing this, critical point methods and other methods from statistical mechanics may be useful.

SUPPORTED BY U.S. Natl. Science Foundation

8.0040, EXPERIMENTAL HIGH ENERGY PHYSICS USING COUNTER TECHNIQUES
M.L. GOOD, State University of New York, School of Arts, *Stony Brook, New York* 11790

An extensive program in the study of the properties of p-p collisions at very high center of mass energies (60 GeV) is being conducted at the CERN Intersecting Storage Ring. The Program, being conducted in collaboration with groups from the Universities of Pisa, Rome and Genoa; MIT and CERN consists of the following measurements: l. Production of large transverse momenta photons. 2. Total cross sections. 3. Multiplicity distributions of events associated with small momentum transfer. 4. Hadron spectra for both law and high transverse momentum events. 5. Differential cross sections for mu pair production. 6. Multiplicity, angular distributions, and two body correlations for events with forward-going negative hadrons. 7. Neutron energy spectra for forward-going events. This information is considered to be important for an understanding of strong interactions of hadrons in regions inaccessible with conventional accelerators.

This work is a continuation of that currently supported by Foundation Grant Number GP-32952, Amendment Number Two.

SUPPORTED BY U.S. Natl. Science Foundation

8.0041, POINT DEFECTS IN IONIC CRYSTALS
L.M. SLIFKIN, Univ. of North Carolina, Graduate School, *Chapel Hill, North Carolina* 27514

Research conducted under NSF Grant DMR-NO35794 will continue. A complementary group of experiments on the interactions between solute ions and other lattice defects in AgCl and AgBr is proposed, using the following techniques: tracer diffusion, ionic conductivity, low temperature depolarization by dipolar complexes, and internal friction as a monitor of dislocation loop pinning. The specific questions to be addressed are as follows: How does the diffusion activation energy of divalent cations depend on electronic structure, polarizability, radius, etc? (2) What is the origin of the refusal of the diffusivity of M2 ion to saturate at high dopant levels? (3) In AgBr/AgCl mixed crystals, how do the Frenkel defect parameters vary with composition? (4) How do the binding energies of solute-vacancy complexes depend on ionic properties? (5) What is the mechanism of the apparent third order kinetics of the aggregation of solute-vacancy complexes? How does it depend on the properties of the ion? (6) Can the strain energy of an iodide ion in AgCl bind a cation vacancy, even in the absence of electrostatic interactions? (7) What is the origin of the apparent negative effective activation energy for the pinning of dislocation loops by solute ions in AgBr:Cd?

SUPPORTED BY U.S. Natl. Science Foundation

8.0042, ELECTRONIC STRUCTURE OF SOLIDS
B. SEGALL, Case Western Reserve Univ., School of Arts, *Cleveland, Ohio* 44106

Studies of several aspects of the electronic struture of solids and alloys and of the electron-phonon interaction previously supported under GH-34563 will be continued. The unifying feature of these projects is that they all involve the use of the Green's function method (which is also referred to as the KKR method) and extensions and new applications to it developed by the principal investigator and co-workers. Areas of research to be undertaken include: (1) Continuation of work on parametrization of energy bands using a very effective approach that we have recently developed. (2) Continuation of work on the calculation of deformation potentials for homogeneous strains by an accurate and convenient method also developed by this group. We also propose to investigate a possible extension of this approach which would provide a convenient means for determining the electron-phonon interaction appropriate for phonons of short wave length. (3) Continuation of work on the calculation of non-muffin-tin corrections to energy bands. (4) The initiation of a program to study the electronic structure of realistic alloys using the GFM.

SUPPORTED BY U.S. Natl. Science Foundation

8.0043, ELECTRONIC PROPERTIES OF AMORPHOUS THALLIUM-TELLURIUM ALLOYS
M. CUTLER, Oregon State University, School of Science, *Corvallis, Oregon* 97331

The studies of the electronic properties of amorphous alloys supported by NSF Grant GH-39305 will be continued. The transport parameters of splat cooled TlxTe (1-x) alloys will be measured as a function of temperature in the range of 4 - 300 degrees K and as a function of composition in the range O less than 0.69. These results will be analyzed for their implications regarding the electronic structure of Tl-Te. Depending on composition, this is expected to yield information in two domains of electronic behavior of disordered systems: hopping transport in localized states (x less than .667) and diffusive transport in semi-metallic, extended states (x greater than .667). Tunnel junctions will be prepared for semi-metallic compositions of the alloy (.667 less than x less than .69) with a sandwich structure alloy- oxide-metal, and their conductance curves will be studies to derive direct information about the electron density of states of the alloy. The semi- metallic alloys will also be investigated for the occurrence of superconductivity in the temperature range above 1.2 degrees K by using tunnel junctions (the Gaiever effect), or by other methods if necessary.

SUPPORTED BY U.S. Natl. Science Foundation

8.0044, THEORY OF MANY-PARTICLE SYSTEMS
M.D. GIRARDEAU, Univ. of Oregon, School of Liberal Arts, *Eugene, Oregon* 97401

Work will continue on the construction and applications of second quantization representations for systems of composite particles. An investigation to understand the connection between quantization of circulation and metastability of superfluid flow in microscopic detail will be started. The model system consists of an ideal Bose gas initially in rotation with respect to a cylindrical container at rest. The cylinder is assured to have a local roughness in this model of a nonequilibrium condition in which a more correct criteria of stability than that by Landau will be sought.

SUPPORTED BY U.S. Natl. Science Foundation

8.0045, APPLICATION OF EXO-ELECTRON EMISSION TO MATERIALS EVALUATION AND TESTING
S.J. CYTRON, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137

To undertake a parametric study of the factors influencing exo- electronemission with the aim of generating pertinent data applicable to materials evaluations and testing.

Initial efforts will be concerned with an assessment of the exoelectron emission effect and an evaluation of various methods for detecting its presence in atmospheric environments. Preliminary test data will be generated using several prototype emission detectors. Emphasis will be given to the ability of these prototype models to detect exo-electron emission from metals under various modes of excitation and stimulation.

Supporting agency address information: ARMCOM Frankford Arsenal, Philadelphia, Pa. 19137.

SUPPORTED BY U.S. Dept. of Defense - Army

8.0046, ELECTRONIC STATES AT SURFACES OF SOLIDS
L. KLEINMAN, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712

Research previously supported under GH-40371 will be continued. The principal investigator has recently developed a method for calculating two dimensional energy bands for thin metal films. The method yields both bulk and surface state energy bands as well as the electronic charge density throughout the film. A self-consistent calculation has been made for (100) lithium. A procedure for obtaining nearly self-consistent potentials in nearly-free-electron metals has been developed and used to study the (100), (110) and (111) faces of aluminum. These calculations will be extended to transition metals for the first time, using an orthogonalized plane wave expansion supplemented by a new kind of d basis function which ensures rapid convergence. The thin film potential will be calculated from a superposition of atomic charge densities using the X gamma exchange potential.

SUPPORTED BY U.S. Natl. Science Foundation

8.0047, THEORETICAL MOSSBAUER EFFECT STUDIES
G.T. TRAMMELL, Rice University, Graduate School, *Houston, Texas* 77001

Theoretical investigations supported by NSF Grant No. GH-32223 will be extended. Previous work on gamma-ray optics to treat the dynamical theory of gamma lasing will be expanded. Preliminary results show that the temporal development of the amplified pulse is of critical importance in determining the proper threshold conditions for neutron pulsed gamma ray laser. If lasing can be achieved in crystals, then Borrmann channels can be used for mode selection. In this case, the multipole nature of the active transition and the position within the unit cell (interstitial or lattice site) determines the strength with which the channel is fed and the strength of the coupling to the channel. A related queston is whether or not such laser could be used to form molecular holograms. Investigations on the use of Kossel analysis for chemical structure determinations, and the use of conversion-photoelectron interference for obtaining atomic information will also be extended.

SUPPORTED BY U.S. Natl. Science Foundation

8.0048, SURFACE STUDIES IN SOLIDS
V. CELLI, Univ. of Virginia, School of Arts, *Charlottesville, Virginia* 22903

Theoretical research on the elementary excitations of surfaces, their interaction with external probes and their role in determining the properties of thin films and layer structures will be undertaken. The possibility that the surface plasmon excitation spectrum for a reconstructed surface has several branches will be investigated in the framework of a microscopic theory that takes explicit account of the periodic electronic structure of the surface. The properties of surface excitations in a cylindrical geometry and the interaction of these excitations with photons and electrons will be examined, with special reference to surface phonons in ionic crystals and surface plasmons.

The interaction of an impinging neutral atom with a surface will be examined taking into account both the deformation of the surface due to the impact of the atom and the recoil of the atom itself.

The influence of interface excitations on the properties of layer structures will be examined. The possibility of surface-plasmon mediated superconductivity will be analyzed, with reference to intercalated MoS2. The contribution of surface excitations to the layer-layer interaction will be studied and the results will be compared with experimental data on interlayer phonons. Finally the interlayer phonon-assisted conductivity will be calculated.

SUPPORTED BY U.S. Natl. Science Foundation

8.0049, INTERACTING EXCITATIONS IN CONDENSED MATTER

J. RUVALDS, Univ. of Virginia, School of Arts, *Charlottesville, Virginia* 22903

Research begun under NSF Grant GH-32747 will be continued. Elementary excitations in various phases of condensed matter have been studied extensively from theoretical and experimental points of view. As a result, there is available a wealth of data concerning the physical properties of phonons and other excitations in solids and in some liquids. With the advent of laser technology, light scattering experiments have provided a senstive probe of excitations and their interactions.

Recently it has been recognized that the effective coupling between elementary excitations in condensed matter may be sufficiently strong to form bound states of excitation pairs. These strong interaction aspects of quasiparticle scattering seem to be quite general and demonstrate the importance of final state interactions in calculations of the scattering cross sections.

An extension of this theoretical research program to study the interactions of excitations in various systems. The goals of the work include the following topics: 1. Microscopic Theory of Roton Interactions in Superfluid Helium. 2. Quasiparticles in He3-He4 Mixtures. 3. Phonon Interactions and Phase Transitions in Solids. 4. Influence of Impurities on Ferroelectrics.

SUPPORTED BY U.S. Natl. Science Foundation

8.0050, DIFFRACTIVE DISSOCIATION AT HIGH ENERGIES

H.J. LUBATTI, Univ. of Washington, School of Arts, *Seattle, Washington* 98105

Work of this group revolves principally about the study of diffractive dissociation at high energies using different experimental techniques. The parts of the program include: 1. Analysis of a 15 GeV/c negative pion-d exposure in the Stanford Linear Accelerator 80' deuterium bubble chamber. 2. A study of diffraction dissociation in negative pion-Helium collisions in the hundred GeV range using a helium streamer chamber at the Fermi National Accelerator Laboratory. 3. Analysis of negative pion-d collisions at 200 and 400 GeV using the hybrid 30 inch bubble chamber system at FNAL.

In addition, the group will be studying the interactions of neutrinos in the 15 foot bubble chamber filled with a hydrogen-neon mixture at FNAL.

This work is a continuation of that currently supported by Foundation Grant Number GP-36293, Amendment Number One.

SUPPORTED BY U.S. Natl. Science Foundation

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, ENVIRONMENTAL DISPOSITIONS AND THE SIMULATION OF ENVIRONMENTS

D. APPLEYARD, Univ. of California, School of Environmental Design, *Berkeley, California* 94720

This project deals with the construction and validation of a dynamic environmental simulator which enables one to 'walk' or 'drive' through small three-dimensional scale models of urban, suburban, and natural environments. The simulator will be brought to operational level by final work on minimizing transient vibrations and other unprogrammed motions, by installation of an improved optical probe, and by implementation of real-time modes of software/hardware control of the simulator system. The final phase of an ongoing simulation appraisal study will be completed simultaneously. Reports will be prepared comparing media and modes of simulation, and specifying the psychological performance of subjects to these and other characteristics of environmental simulation. To prepare the system for subsequent research use, a number of small-scale experiments will be performed involving different lighting conditions and sun positions, the addition of sound track to simulation film, and view tests from high-rise buildings. In addition, a report will be prepared on the experience of constructing the simulation laboratory, including descriptions of the equipment, rejected alternatives, model and film-making materials, time and budget costs, operating conditions, and recommendations for future uses.

SUPPORTED BY U.S. Natl. Science Foundation

9.0002, COMMAND AND CONTROL MICROECONOMIC THEORY APPLIED TO INFORMATION SYSTEMS

J. MARSCHAK, Univ. of California, School of Business Admin., *Los Angeles, California* 90024 (N00014-69-A-0200-4005)

This task is part of the research program in support of future developments in Naval Logistic Management Systems. This research is directed toward the development of the necessary quantitative methods for evaluating models of the decision processes of individuals and organizations.

Computerized information systems accumulate and process large volumes of data of which little is known about its value or worth as information in the decision and organization theory to provide the user with criteria for choosing the most effective information system based on the maximum expected benefit to the user.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

9.0003, COMMAND AND CONTROL - COMPUTER AUGMENTED RETRIEVAL SYSTEM

D.C. ENGLEBART, Stanford Research Institute, *Menlo Park, California* 94025 (N00014-70-C-0302)

Increasing complexities in Weapons System Management require more responsive retrieval systems to keep abreast of such factors as status and change information for force levels, material inventories, financial data, etc. Unfortunately, current retrieval systems, even those embedded in the time-sharing technology, require a trained programmer to operate them. This research effort has the objective of building a prototype, generalized information retrieval system in which flexible software capabilities will be provided to enable non-computer-trained personnel to interact, on-line, with their own files in an atmosphere that approximates their own functional environment.

The emphasis is now being placed on using ARC developed techniques to enhance the capabilities of work centers or 'knowledge workshops' such as are found in most organizations. An ARC utility is being developed to deliver knowledge workshop services to a wider range of groups who want to participate as users and developers of a workshop system.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

9.0004, MANAGEMENT SYSTEMS RESEARCH STUDY
A.V. BRUNO, Univ. of Santa Clara, School of Business Admin., *Santa Clara, California* 95053 (NSG 2036)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0005, ECONOMIC THEORY AND ECONOMETRICS
M. SHUBIK, Yale University, School of Social Science, *New Haven, Connecticut* 06520

The principal investigators and their associates at Cowles will continue and expand their research in 1) descriptive and optimal growth, 2) general equilibrium and game theory, 3) behavior under risk and the economics of information, 4) macroeconomics and monetary theory and policy, 5) econometrics and 6) the public sector.

Included among other sub-topics are the following: In growth studies attention centers on models of natural resource use, especially energy resources, and the analysis of uncertainty about future technology in these models. Four directions of research are being pursued in the study of general equilibrium; the development of techniques for the numerical solution of general equilibrium models; the application of non-standard analysis to the study of economic equilibria with an infinite number of agents; the relationship between game theory and the Walrasian model; and the incorporation of monetary considerations in a general equilibrium framework. Research on behavior under uncertainty emphasizes the development of basic concepts, extension of portfolio models, and general equilibrium models incorporating considerations of risk. Investigations into the economics of information and the interaction of risk, imperfect information and economic incentives have also been initiated. In both theoretical and empirical dimensions the thrust of Cowles research in macroeconomics is to extend simple aggregative specifications of economic relationships by an analysis of underlying microeconomic behavior. Work on the public sector is proceeding along three principal lines: social choice and voting; legal policy and regulation; and taxation and public expenditure.

SUPPORTED BY U.S. Natl. Science Foundation

9.0006, INVESTIGATIONS OF MIMS APPLICATIONS
J. HERSON, Howard University, Graduate School, *Washington, District of Columbia* 20001 (NSG 5016)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0007, OPERATION OF THE COMPUTER SOFTWARE MANAGEMENT INFORMATION CENTER
UNKNOWN, Univ. of Georgia, Graduate School, *Athens, Georgia* 30601 (NASW 2658)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0008, COMMAND AND CONTROL - MATHEMATICAL THEORY RELATED TO ECONOMIC-DECISION ANALYSIS
K.J. ARROW, Harvard University, School of Arts, *Cambridge, Massachusetts* 02138 (N00014-67-A-0298-0019)

This research is directed towards the development of a mathematical based theory of economic decision analysis for analyzing complex economic problems. A particular area of research is the use and cost of information available in an organization, and how it is distributed within an organization for effective decision making.

The research is attempting to develop, through the use of mathematical control theory, capabilities which will permit positive control over large complex systems. The particular areas of concern include the information flow and structure, means of information filtering, a concept of local analysis for improving a given situation but not being able to reach a genuine optimal because of problem complexities.

Supporting agency address information: Office of Naval Research 434, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

9.0009, EARTH OBSERVATION DATA MANAGEMENT SYSTEM
R.P. MORGAN, Washington University, Graduate School, *St. Louis, Missouri* 63130 (NAS 5-20680)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0010, COMPARISON OF INTERCITY TRAVEL MODES
M.F. FELS, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (NSG 2037)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

9.0011, COMMAND AND CONTROL--INFORMATION REGENERATION AS AN INFORMATION RETRIEVAL TECHNIQUE
J. BELZER, Univ. of Pittsburgh, Knowledge Availabil. Sys. Ctr., *Pittsburgh, Pennsylvania* 15213 (N00014-67-A-0402-0007)

The increasing amount of technical information which needs to be readily available has made it imperative for the Navy to search for more efficient ways to store and retrieve information. The major objective of this research is to develop a methodology to regenerate information without having to store the entire mass of relevant data or relevant facts. Particular attention will be paid to the regeneration of whole texts from abstracts and/or extracts; and to the development of techniques which organize the abstracting techniques to facilitate automatic recreation of either the total text or the fundamental concepts inherent in the full text.

The approach is to (1) investigate the nature and characteristics of regeneration algorithms, (2) determine classes of problems for which single algorithms can be developed, and then (3) develop test abstracts/extracts which may be suitable for information regeneration.

Supporting agency address information: Office of Naval Research 437, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

9.0012, STUDY OF THE SERIOUS SHORTAGE OF MINORITY HIGH SCHOOL GRADUATES PURSUING HIGHER EDUCATION IN QUANTITATIVE AREAS
J.A. BELL, Hampton Institute, Graduate School, *Hampton, Virginia* 23368 (NSG 1088)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ANALYSIS OF SELECTED ELEMENTS IN METEORITES AND RELATED TERRESTRIAL ROCKS
C.B. MOORE, Arizona State University, School of Liberal Arts, *Tempe, Arizona* 85281

This is a continuation of research supported under NSF Grant GA- 32297X and Amendment No.1. This research involves chemical analyses of meteorites and terrestrial rocks, emphasizing the volatile elements carbon, nitrogen, and sulfur. These elements are particularly important for understanding the temperature histories of the earth and other planets, the development of the atmosphere and oceans on the earth, and the origin of life. The meteorite data will provide a unique record of chemical processes during formation of the planets. The data from terrestrial rock samples will help understand the transfer of the volatile elements in the earth, the production of gases (water, carbon dioxide, nitrogen) within the earth, and the formation and

evolution of the earth's atmosphere and oceans. The chemical information obtained from this study will provide basic data for understanding the formation and later history of the earth and other planets in the solar system.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, THE STRUCTURE OF INTERPLANETARY MAGNETIC FIELDS AND ITS HISTORY BACK TO 7000 B. C.
C.Y. FAN, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721

This grant provides continued support of two research programs: (1) probing the structure of the interplanetary magnetic fields by measuring the 'scintillation' of high energy cosmic-ray particles, and (2) studying the history of solar activity back to 7000 B. C. by measuring the variation of C 14 intensity in dated tree rings. The experiments on the structure of the interplanetary magnetic fields are being carried out with two mirrors on Mt. Hopkins, with photomultiplier tubes placed at the focal points of the mirrors. On moonless clear nights, high energy cosmic ray flux can be measured by detecting the air Cverenkov lights produced by the shower particles of these primaries. The C 14 work involves a highly accurate sensor, which will enable the investigators to look at long period fluctuation in the cosmic ray intensity.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, ENERGETIC PARTICLES FLUX EXPERIMENT FOR INTERNATIONAL SUN-EARTH EXPLORER MOTHER & DAUGHTER SPACECRAFT
K.A. ANDERSON, Univ. of California, School of Letters, *Berkeley, California* 94720 (NAS 5-20079)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0004, QUANTUM FLUCTUATIONS OF GRAVITATION AND ELEMENTARY PARTICLES AS EXCITONS IN A TURBULENT GRAVITATIONAL FIELD
K. WOEHLER, U.S. Navy, Postgraduate School, *Monterey, California* 93941

To construct on the basis of Einstein's theory of gravitation a unified theory of matter in which elementary particles are interpreted as exciton like coherent perturbations of space-time structure. Such theory could explain the mechanism and ultimate state of gravitational collapse and the origin of matter in singular cosmologies.

In Einstein's field equation with zero matter tensor, the metric tensor is interpreted as being an average metric superimposed by a short wave fluctuation of wavelength 10 to the minus 33 power cm representing vacuum quantum fluctuations of virtual energy density 10 to the minus 115 power erg/cm cubic which average to zero, and very small coherent inhomogeneities of these fluctuations which constitute an average energy density and are to be associated with elementary particles. It is to be investigated whether the resulting non-linear theory for the correlation functions representing the coherent geometric space-time structures have, in fact, stable solutions resembling a spectrum of particles. Main difficulty is the incorporation of the quantum constant in an appropriate way.

Supporting agency address information: Office of Naval Research, Arlington, Va. 22217.

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0005, ANALYSIS OF LUNAR ROCKS
B. MASON, Smithsonian Institution, *Washington, District of Columbia* 20560

The major work under this project is the characterization of lunar minerals and rocks in terms of their physical properties, chemical compositions, and distribution of minor and trace elements, with parallel studies of comparable meteoritic and terrestrial materials and synthetic melts. The aim is to decipher the geological history of the landing sites from the mineralogical, petrographic, and chemical composition of the materials returned, correlating this information with the ground-based observations of the astronauts and the results of geophysical experiments. Our ultimate objective is the elucidation of the major problems of the origin and history of the Moon, and its relationship to other bodies in Solar System, particularly the Earth and the asteroids and meteorites.

SUPPORTED BY Smithsonian Institution

10.0006, DETERMINATION OF THE MOTION OF THE MOON
R.L. DUNCOMBE, U.S. Navy, Observatory, *Washington, District of Columbia* 20390

Support and augment the technical/operational programs and activities of the U.S. Naval Observatory in accordance with its Navy and Department of Defense Mission on navigation, and time determination, by improving the constants of the moon, and its reference system from analysis of observations.

Occultation data, precise lunar photographs, solar eclipse timings, laser ranging measurements and the motion of the reference system, and meridian circle observations of the moon will be analyzed for the motion of the moon, the exact figure of the moon, and the lunar profile and its liberations.

Supporting agency address information: Naval Observatory, Washington, D.C. 20390.

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0007, DEVELOPMENT OF IMPROVED PLANETARY AND SATELLITE MOTIONS
R.L. DUNCOMBE, U.S. Navy, Observatory, *Washington, District of Columbia* 20390

Support and augment the technical/operational programs and activities of the U.S. Naval Observatory in accordance with its Navy and Department of Defense Mission on navigation, and time determination, by studying the motions of the planets and satellites to improve the accuracy of their calculated positions at past and future times. These theories are basic to the navigational tables and almanacs used for surface, air and space navigation.

Construct mathematical theories of the motions of the planets and satellites, compare these motions with observations, determine constants for the theories and other astronomical constants, and adapt the theories to practical use. Ephemerides of planet and satellite positions are computed based on these improved theories.

Supporting agency address information: Naval Observatory, Washington, D.C. 20390.

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0008, SPECIALIZED ASTRONOMICAL COMPUTATIONS
R.L. DUNCOMBE, U.S. Navy, Observatory, *Washington, District of Columbia* 20390

Support and augment the technical/operational programs and activities of the U.S. Naval Observatory in accordance with its Navy and Department of Defense Mission on navigation, and time determination, by preparing specialized astronomical computations.

The specialized astronomical computations are prepared in support of the work of the other divisions of the Naval Observatory, Navy Programs and DOD Programs. Examples are preparation of specialized astronomical data for Polaris-Poseidon Missile Guidance System and for Polaris Submarine Star Tracker, special lunar position computations for use with the Ballistic Missile Early Warning System and development of special tables of sunrise and sunset or moonrise and moonset for tactical and/or intelligence purposes.

Supporting agency address information: Naval Observatory, Washington, D.C. 20390.

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0009, COMPILATION OF REFERENCE STAR CATALOGS
J.L. SCHOMBERT, U.S. Navy, Observatory, *Washington, District of Columbia* 20390

Compile catalogs of accurate positions of 20,000 reference stars in each hemisphere of sky in support of Naval Observatory Mission in time determination and navigation.

(1) reduce all reference star observations made with Naval Observatory seven-inch transit circle telescope at El Leoncito, argentina to a system of reference defined by fundamental stars (2) coordinate observations of reference stars being made at 20 cooperating observatories (3) collect all results of observations of reference stars, analyze, and compile catalogs of final positions.

Supporting agency address information: Naval Observatory, Washington, D.C. 20390.

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0010, INTERPLANETARY MEDIUM AND ASTRONOMICAL STUDIES USING A LARGE RADIO TELESCOPE
S.D. SHAWHAN, Univ. of Iowa, School of Liberal Arts, *Iowa City, Iowa* 52240

This grant supports continued work on a relatively new research effort to use interplanetary scintillation (IPS) to study properties of the solar wind and interplanetary medium. The effect arises when the signals of radio sources, outside the solar system, are diffracted by variations in solar wind electron densities as they propagate. Thus, with the proper combination of theory and experiment, it is possible to determine the solar wind properties along the path of the incoming radio signal. The advantage of this technique is that it gives access to regions of the solar system which are not yet accessible by spacecraft: particularly out of the ecliptic plane and close to the sun. The NOAA/Iowa Clark Lake Facility construction has been completed and is now operational, though it is still undergoing some testing.

SUPPORTED BY U.S. Natl. Science Foundation

10.0011, MEASUREMENT OF TRITIUM AND ARGON IN RETURNED LUNAR MATERIALS - ISOTOPIC STUDIES
E.L. FIREMAN, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NGR 09-015-145)

1. Measure Ar37, Ar39, and H3 as a function of depth in the deep core of a large documented rock from Apollo 17.

2. Continue to measure the Ar39 and H3 in two large documented rocks of different chemical compositions from either Apollo 17 or previous Apollo missions.

3. Also measure Ar39 production cross sections in thick Ti, Ca, and K targets bombarded with protons of energies between 50 and 600 Mev.

4. Measure H3 in four quadrants of oriented aluminum tube G3 from Surveyor 3. Determine ages and histories of meteorites by means of isotope measurements.

SUPPORTED BY Smithsonian Institution

10.0012, GALACTIC DYNAMICS - CELESTIAL MECHANICS - SOLAR SYSTEM DYNAMICS
M. LECAR, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Drs. Lecar and F. Franklin continued their study of the dynamical evolution of the asteroid belt. Orbits between 3.3 and 4.0 AU were found to be stable for thousands of years, but this region is unpopulated in the solar system. They are now studying the very long term perturbations of Jupiter. W. Wiesel, a doctoral student of Lecar, established that Jupiter's resonant perturbations produced gaps in the asteroid belts at the observed locations, but concluded that an additional mechanism, such as collisions, is required to clean out the gaps.

Lecar studied the tidal circularization of close binary stars. With J.C. Wheeler and C. McKee, they were able to satisfactorily explain the observed low eccentricity of the binary X-ray source Hercules X-1. However, they concluded that the source in Centauris X-3 is probably spiralling into the primary.

With G. Mybicki and M.M. Schaefer, Lecar completed a study of the rotation curves of spiral galaxies. They concluded that a substantial mass could exist exterior to the measured rotation curves without distorting those curves. This rationalized the 21 cm observations of M. Roberts at NRAO who found that this was the case in the nearby galaxy Andromeda.

SUPPORTED BY Smithsonian Institution

10.0013, VERY LONG BASELINE INTERFEROMETRY
J.M. MORAN, Smithsonian Institution, *Cambridge, Massachusetts* 02138

In cooperation with various institutions, very long baseline interferometry experiments are conducted to determine the spatial structure of molecular line emission from galactic radio sources.

SUPPORTED BY Smithsonian Institution

10.0014, STELLAR PHYSICS
R.W. NOYES, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Observations were conducted and data analysis begun from the Harvard College Observatory extreme ultraviolet spectrometer on Skylab to study physical conditions in the solar chromosphere and corona. Main areas of study include heating and energy balance of the corona, structure of active regions, prominences, coronal holes, solar flares, etc. Data analysis will continue for several years.

Observations of G stars were made using the Copernicus satellite. MgII (K-line) was detected, and further observations will be made to detect the H-line. Observations and analysis of the data are continuing.

Observations in the far infrared spectrum were made, in cooperation with the Harvard College Observatory, using a 40 inch telescope launched on a high-altitude balloon.

SUPPORTED BY Smithsonian Institution

10.0015, TIME OF CRAB OPTICAL PULSAR
C. PAPALIOLIOS, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (SRF 430064)

Observations of the Crab Nebula pulsar are made to gather sufficient data for an understanding of the dynamics of rotating neutron stars and of the reasons for their occasional departure from a smooth secular slowdown. In addition, searches were conducted for new optical pulsars.

SUPPORTED BY Smithsonian Institution

10.0016, THE STRUCTURE AND EVOLUTIONARY STATUS OF BE STARS
R.E. SCHILD, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Objective: BE stars are in a stage of evolution during which a disk of gas forms around the star, the disk manifesting itself in hydrogen emission lines. A quantitative study of the conditions in this envelope and in the atmosphere of the star provides information about the evolution of hot stars.

Approach: Observations of energy distributions and spectral line strengths have been made for several Be stars. These data will be combined with model computations of the envelope to derive quantitative values of the temperature, density and state of ionization.

Progress: The energy distributions and line strengths have been measured. The model computations have been initiated, and the detailed comparison with the data will begin shortly.

Future: Additional stars will be observed to extend the results found here.

SUPPORTED BY Smithsonian Institution

10.0017, DYNAMICAL AND PHOTOMETRIC INVESTIGATION OF COMETARY II TAILS
Z. SEKANINA, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (NGR 09-015-159)

Collect suitable observational material and subject them to critical evaluation. Examine techniques for obtaining isophotometry and translation of the Finson-Probstein computer program into existing computer language.

Continue photometry on suitable comet plates. Establish first- approximation hypotheses for the space-density, particle-size and initial- velocity distributions.

Refine distribution functions of the models to obtain best agreement between measured and computed isophotos.

SUPPORTED BY Smithsonian Institution

10.0018, LUNAR AND PLANETARY SCIENCE - HYDROGEN MASER EXPERIMENTS
R.F. VESSOT, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Development of Hydrogen Maser Systems for ground-based radio- astronomy applications and for satellite, balloon, and rocket experiments designed to measure the gravitational redshift and other principles basic to the theory of general relativity.

SUPPORTED BY Smithsonian Institution

10.0019, STUDY OF GEOLOGICAL MATERIALS BY THE METHODS OF PARTICLE TRACKS, THERMOLUMINESCENCE, AND RARE GASES
R.M. WALKER, Washington University, School of Arts, *St. Louis, Missouri* 63130

This is a continuation of research supported under NSF Grant GA- 25845 and Amendment No. 1. This project involves study of radiation effects (fission tracks, thermoluminescence, rare gases) in natural materials (meteorites, terrestrial rocks, archeological samples). Particular projects involve: (1) detection of extinct radioactive elements in meteorites; (2) study of nuclear chain reactions produced in terrestrial uranium ore deposits; (3) age-dating of very young objects using thermoluminescence. The research will provide fundamental data about the ages and temperatures of formation of rocks and meteorites, chemical processes during the formation of the solar systems, and the ages of very young geological and archeological materials.

SUPPORTED BY U.S. Natl. Science Foundation

10.0020, GEOLOGIC INTERPRETATION OF LUNAR PHOTOGRAPHY
W.E. ELSTON, Univ. of New Mexico, School of Arts, *Albuquerque, New Mexico* 87106 (NSG 7066)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

10.0021, A STUDY OF THE FUTURE UTILIZATION OF SPACE ENVIRONMENT
M. EISNER, Univ. of Houston, School of Arts, *Houston, Texas* 77004 (NAS 9-14316)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

VOLUME 13 NUMBER 2 / JANUARY 23, 1975

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N75-10900*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PERTURBATIONS IN FLIGHT MECHANICS
Mark D. Ardema Aug. 1974 222 p refs
(NASA-TM-X-62380) Avail: NTIS HC $7.25 CSCL 01B

The singular perturbation theory of ordinary differential equations is applied to optimal control problems and to trajectory optimization problems of flight mechanics. A solution procedure employing the method of matched asymptotic expansions is developed. For the state regulator problem of optimal control theory, rigorous results are obtained which give conditions under which the method is applicable. The singular perturbation theory of nonlinear equations is reviewed and applied to optimal control problems. To illustrate the solution procedure, the method is used to solve the minimum time-to-climb problem. The zeroth order solution proves to be a poor approximation but the first order solution gives a good approximation for both the trajectory and the minimum time to climb. Author

N75-10901# Sandia Labs., Albuquerque, N.Mex.
INTERACTIVE AND OFF-LINE COMPUTER GRAPHICS APPLIED TO THE THEORETICAL AIRCRAFT/STORE SEPARATION PROBLEM
H. R. Spahr 1973 38 p refs Presented at the Conf. on Computer Graphics and Interactive Tech., Boulder, Colo., 15-17 Jul. 1974 Sponsored by AEC
(SLA-73-5935; Conf-740706-2) Avail: NTIS HC $3.75

A computer code was developed which computes the theorectical trajectory of a store in the complex flow field after release from an aircraft flying at subsonic speeds. Views of the graphics console are used to illustrate how an interactive graphics computer code, SOURCE, is used to prepare source and sink theoretical aerodynamic models for the aircraft fuselage, nacelles, gas tanks, and store body. Usage of this interactive code reduces the calendar time required to develop a source and sink model from approximately two weeks to one hour. Computer generated color slides and color movies of two theoretical store separations were used to illustrate the visual documentation provided by computer code MOVIE1, using an off-line cathode ray tube plotter. Techniques are discussed which reduce the computer time required for one store separation to a few seconds to generate color slides, and to a few minutes to generate color movies. Author

N75-10902# Picatinny Arsenal, Dover, N.J.
DESCRIPTION OF THE REVISED AERO 1 PROGRAM, PA NO. 010417
E. M. Friedman Jun. 1974 38 p refs
(AD-784085; PA-TM-2151) Avail: NTIS CSCL 20/4

A description is given of a computer program, AERO 1, which computes a two degree of freedom, point mass trajectory. A sketch is given of the form of the analytics with a thorough description of the input. The program solves the one-dimensional equation of spin independently of the point mass trajectory, except that the dynamic pressure computed by the point mass solution for any instant of time is a parameter of the spin problem. This spin is used to compute the classical ballistic stability criteria, if desired. A description and proof of a technique for exactly simulating the effects of constant crosswind and/or range wind is appended. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N75-10903# Committee on Science and Astronautics (U. S. House).
GENERAL AVIATION PROGRAMS
Washington GPO 1974 35 p Rept. prepared by Subcomm. on Aeron. and Space Technol. of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., 16 Oct. 1974
(GPO-41-153) Avail: Subcomm. on Aeron. and Space Technol.

The hearings concerning general aviation are reported. Conclusions and recommendations include: (1) general aviation makes a significant contribution to the air transportation system. In addition to offering service between major cities, it provides the only air transportation to many locations not served by scheduled air carriers. General aviation aircraft are used for a broad range of purposes, e.g., from business flying to direct commercial and agricultural applications; (2) general aviation makes a strong input to our economy by generating employment and revenue; (3) a principal requirement of general aviation is the development of technology to meet stringent Federal regulation on noise abatement and exhaust emissions; (4) it is essential that NASA maintain close communication with the general aviation community. F.O.S.

N75-10904# Commissariat a l'Energie Atomique, Grenoble (France).

MOORED OBSERVATION BALLOON AND MEASUREMENTS AT 6000 METERS
P. Perroud, A. Robuchon, and M. Sylvestre-Baron Oct. 1973 13 p refs In FRENCH Presented at the AERALL Colloq., Paris, 12 Nov. 1973
(CEA-Conf-2561) Avail: AEC Depository Libraries HC $4.00

It is possible to adapt a classic 10,000 cu m Aerazur moored balloon with an expandable keel to flight conditions at 6,000 m altitude. In order to do this three air bags with a total volume of 4,500 cu m are introduced into the keel; they can be progressively deflated to compensate for the volume variation. The steel or fiber glass mooring cable has copper wire attached for the electrical power of the gondola. Author (NSA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *Communications*.

N75-10905*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON TIME SCALES AND TIME SYNCHRONIZATION USING LORAN-C AS A TIME REFERENCE SIGNAL
A. R. Chi Sep. 1974 55 p refs Presented at the NASA-DOD PTTI Meeting, Naval Research Lab, 3-5 Dec. 1974
(NASA-TM-X-70774; X-810-74-284) Avail: NTIS HC $4.25 CSCL 17G

The long term performance of the eight LORAN-C chains is presented in terms of the Coordinated Universal Time (UTC) of the U.S. Naval Observatory (USNO); and the use of the LORAN-C navigation system for maintaining the user's clock to a UTC scale is described. The atomic time scale and the UTC of several national laboratories and observatories relative to the international atomic time are reported. Typical performance of several NASA tracking station clocks, relative to the USNO master clock, is also presented. Author

N75-10906*# Prairie View Agricultural and Mechanical Coll., Tex. Dept. of Electrical Engineering.
RADAR CROSS SECTIONS OF STANDARD AND COMPLEX SHAPE TARGETS Final Report, 1 Sep. 1973 - 30 Nov. 1974
M. S. Sohel 30 Nov. 1974 94 p refs
(Grant NGL-44-033-017)
(NASA-CR-140756) Avail: NTIS HC $4.75 CSCL 17I

The theoretical, analytical, and experimental results are described for radar cross sections (RCS) of different-shaped targets. Various techniques for predicting RCS are given, and RCS of finite standard targets are presented. Techniques used to predict the RCS of complex targets are made, and the RCS complex shapes are provided. Author

N75-10907# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TERCOM PERFORMANCE: ANALYSIS AND SIMULATION Final Report, 19 Oct. 1972 - 15 Nov. 1973
Mark W. Cannon, Jr. and Joseph W. Carl Jun. 1974 71 p refs
(AF Proj. 7233)
(AD-783804; AMRL-TR-73-130) Avail: NTIS CSCL 17/7

A theoretical analysis of the performance of a nearest-prototype classifier (nearest in the sense of Euclidean distance) is presented as an approximate analysis of the performance of the Terrain Contour Matching Navigation System (TERCOM). The analysis is used to predict classifier performance on both artificially generated terrain with Gauss-Markov statistics and on real-world terrain. Over 150 simulation runs were performed over such terrain having added Gauss-Markov noise (independent of the terrain process) with 6 different noise levels. Results of the simulation are presented, giving performance as a function of signal/noise ratio and as a function of terrain roughness. Measured miss-distances are also presented. The simulation also invludes the performance of a nearest-prototype classifier based on mean absolute distance (the first Minkowski metric), which is the actual metric employed in TERCOM. (Modified author abstract) GRA

N75-10908# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
WANDER AZIMUTH IMPLEMENTATION ALGORITHM FOR A STRAPDOWN INERTIAL SYSTEM Technical Report, Nov. 1972 - Mar. 1973
Peter S. Maybeck Oct. 1973 69 p refs
(AF Proj. 1987)
(AD-784752; AFFDL-TR-73-80) Avail: NTIS CSCL 17/7

The report develops the algorithm for deriving attitude, heading, and navigation information from a strapdown inertial system. Beginning with the fundamental physical relationships, it develops all required equations and progresses to the onboard implementation of the algorithm. Significant features of the algorithm include: (1) computations performed in the wander azimuth coordinate frame to provide a system capable of operating in the polar regions; (2) separation into four loops of different interaction rates. This maintains rapid, accurate updating of the direction cosine matrix involving vehicle attitude, while processing other information and extracting display data at appropriately slower rates; (3) fourth order Runge-Kutta integration of quaternions, using second order rate extraction, to update the attitude direction cosine matrix; (4) specification of the computations that require double precision for adequate performance; (5) third order damping of the vertical channel by means of barometric altimeter data. The applicability of this algorithm to a range of vehicle and mission environments is indicated, the required adaptations being easily performed for each particular implementation. Author (GRA)

N75-10909# Rome Air Development Center, Griffiss AFB, N.Y.
THE WEIGHTED LEAST SQUARES WITH CONSTRAINT PARAMETERS AS APPLIED TO CIRCULAR AND HYPERBOLIC POSITIONING
George A. Ellis and Windsor S. Thomas Jun. 1974 114 p refs
(AF Proj. 4019)
(AD-784817; RADC-TR-73-390) Avail: NTIS CSCL 17/7

An evaluation of the performance of circular (Range-Only) and hyperbolic (Range-Difference) position location systems was undertaken with respect to accuracy in the location of a cooperative or uncooperative ground-based emitter and the parameters which affect it. The system performance was evaluated using the Weighted Least Squares Adjustment with Constraint Parameters. The matrix representation of this technique was programmed for the RADC TTS/645. In the circular system a 15.3% improvement in the Distance Measuring Equipment (DME) emitter's positional accuracy was noted when the number of Relay Aircraft (A/C) range measurements increased from two to six. In the hyperbolic system, the emitter could be located to within a standard deviation of 140 feet when the range propagation error was 15 Parts Per Million (PPM). There was no need for the three A/C to maintain a synchronous pattern if the radii of the circles which the aircraft are flying are less than 15 NM. Employing the above-mentioned statistical analysis, the merits of each system (the Range-Only and Range-Difference measurement techniques) were independently evaluated within the confines of a specified scenario. In addition, the computational program may easily and readily be modified to encompass a specific system employing these measurement techniques. Author (GRA)

N75-11243 Joint Publications Research Service, Arlington, Va.
NAVIGATION SYSTEM IN THE SINGLE STAR ASTROCORRECTION MODE
M. A. Sergeyev and V. I. Yushchenko *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 11-16 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 68-73 (For availability see N75-11240 02-35)

N75-11270* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLOBAL RESCUE ALARM NET (GRAN) EXPERIMENT

James C. Morakis *In* Its Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 259-266 (For availability see N75-11249 02-35)
CSCL 17G

N75-11274* Naval Electronics Lab. Center, San Diego, Calif.
OMEGA TIMING RECEIVER, DESIGN AND SYSTEM TEST
John J. Wilson, James E. Britt, and Andrew Chi (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 345-361 refs (For availability see N75-11249 02-35)
CSCL 17G

N75-11279* Naval Research Lab., Washington, D.C.
APPLICATIONS OF RADIO INTERFEROMETRY TO NAVIGATION
S. H. Knowles, Kenneth J. Johnston, and E. O. Hulburt *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 47-58 (For availability see N75-11275 02-35)
CSCL 17G

N75-11293* Coast Guard, Washington, D.C.
ALL CHAIN LORAN-C TIME SYNCHRONIZATION
H. T. Sherman *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 317-336 (For availability see N75-11275 02-35)
CSCL 17G

N75-11294* International Astronomical Latitude Station, Cagliari (Italy).
STABILITY AND NOISE SPECTRA OF RELATIVE LORAN-C FREQUENCY COMPARISONS
Edoardo Proverbio, V. Quesada, and A. Simoncini *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 337-348 refs (For availability see N75-11275 02-35)
CSCL 17G

N75-11295* Federal Aviation Administration, Washington, D.C.
AN AERONAUTICAL BEACON SYSTEM USING PRECISE TIME
T. S. Amlie *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 349-367 (For availability see N75-11275 02-35)
CSCL 17G

N75-11296* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOCK SYNCHRONIZATION EXPERIMENTS USING OMEGA TRANSMISSIONS
Andrew R. Chi and S. C. Wardrip *In its* Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 369-395 refs (For availability see N75-11275 02-35)
CSCL 17G

N75-11299* Naval Electronics Lab. Center, San Diego, Calif.
A SYNOPTIC STUDY OF SUDDEN PHASE ANOMALIES (SPA'S) EFFECTING VLF NAVIGATION AND TIMING
E. R. Swanson and C. P. Kugel *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 443-475 refs (For availability see N75-11275 02-35)
CSCL 17G

N75-11300* Army Topographic Command, Washington, D.C.
RESULTS OF THE LONG RANGE POSITION-DETERMINING SYSTEM TESTS
Frederick W. Rhode *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 477-502 (For availability see N75-11275 02-35)
CSCL 17G

N75-11431* Scientific Translation Service, Santa Barbara, Calif.
DETERMINING SPACECRAFT AND AIRPLANE ANGULAR ORIENTATION FROM STAR PHOTOGRAPHS
K. I. Elbakyan *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 136-143 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 118-123 (For availability see N75-11419 02-43)
CSCL 17G

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N75-10910 Society of Flight Test Engineers, Lancaster, Calif.
ADVANCEMENTS IN FLIGHT TEST ENGINEERING
1974 403 p refs Presented at the 5th Ann. Symp. of the Soc. of Flight Test Eng., Anaheim, Calif., 7-9 Aug. 1974
(LC-74-136-52) Copyright. Avail: Issuing Activity CSCL 01B

The proceedings of a symposium on advancements in flight test engineering are presented. The subjects discussed include the following: (1) developing short takeoff and landing operational criteria, (2) avionic system testing, (3) test data acquisition, processing, and analysis, and (4) environmental testing. Specific examples of aircraft on which tests were conducted are provided. Specialized systems for conducting tests and recording flight test data are explained. Emphasis is placed on the use of simulators for research and development as well as operational evaluation of weapon systems. For individual titles, see N75-10911 through N75-10932.

N75-10911 National Aviation Facilities Experimental Center, Atlantic City, N.J.
DEVELOPING STOL OPERATIONAL CRITERIA
Roman M. Spangler *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 62 p (For availability see N75-10910 02-05)

A DeHavilland DHC-6, Series 100 Twin Otter was flown by a representative group of pilots on various steep-gradient approaches onto a ground-level STOL runway. Approximately 800 approaches and landings were accomplished to provide a data base to approve a first-generation STOL operation. Areas investigated included: (1) aircraft handling and response on steep-gradient approaches with various approach electronic beam sensitivities, (2) location of the ground point of intercept; (3) co-located versus split localizer/glideslope signal source; (4) obstacle clearance requirements; (5) field length requirements; and (6) influence of command-steering on aircraft/pilot performance. Author

N75-10912* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
NASA FLIGHT RESEARCH CENTER SCALE F-15 REMOTELY PILOTED RESEARCH VEHICLE PROGRAM
Garrison P. Layton *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 14 p refs (For availability see N75-10910 02-05)
CSCL 01B

A remotely piloted research vehicle (RPRV) program was conducted with a 3/8-scale model of an F-15 airplane to determine the usefulness of the RPRV testing technique in high risk flight testing such as spin testing. The results of the first flights of the program are presented. The program has shown that the RPRV technique, including the use of a digital control system, is a viable method for obtaining flight research data. Also presented are some negative aspects that have been learned about the RPRV technique in terms of model size, command frequency, and launch technique. Author

N75-10913 Naval Missile Center, Point Mugu, Calif. Planning and Resources Management Office.
ADVANCEMENTS IN THE TEST AND EVALUATION OF NAVAL WEAPONS SYSTEMS c09

Thaddeus P. Perry and Robert J. Warnagieris *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 13 p (For availability see N75-10910 02-05)

The structure, methodologies, and functions of the Naval Air Systems Command are discussed with emphasis on research and development of weapon systems. The test and evaluation concept of systems analysis is explained and specific examples are cited. The development and utilization of a photographic data analysis system are examined. The improvements in various flight simulators and test facilities are described to show advancements in testing techniques. Author

N75-10914 Naval Air Development Center, Warminster, Pa.
THE R AND D SIMULATOR: A NEW T AND E TOOL **c09**
Robert L. Fortenbaugh *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 18p(For availability see N75-10910 02-05)

A NASA-Ames R and D (research and development) simulator was utilized through the development phase of the F-14A program and on a continuing basis into the T and E (test and evaluation) phase. This utilization has concentrated on development and evaluation of the APC (Approach Power Compensator), AFCS (Automatic Flight Control System), and ACLS (Automatic Carrier Landing System). The importance and success in use of this simulator during the T and E phase is discussed with respect to accuracy of duplicating and predicting flight test results, pilots acceptance of the simulator as a valid representation of the real airplane, and cost effectiveness for reducing flight time while increasing flexibility. The success of this program has led to the adoption of a similar approach for APC, AFCS, and ACLS development for the S-3A airplane and for reevaluation of the A-7E ACLS capability. Author

N75-10915 Naval Air Test Center, Patuxent River, Md. Flying Qualities and Performance Branch.
FLIGHT FIDELITY TESTING OF US NAVY OPERATIONAL FLIGHT TRAINERS **c09**
R. Thomas Galloway *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p (For availability see N75-10910 02-05)

The utilization of flight test results and techniques to improve Operational Flight Trainers (OFT) is discussed. An OFT is a simulator designed to represent a specific aircraft in the service inventory. A typical device consists of a cockpit or set of cockpits having the same interior appearance as the real aircraft including functional instruments, an instructor station for monitoring and controlling various flight parameters, a digital computer system for solving the equations of motion and systems routines, and a hydraulic system for the control stick and motion base servo-mechanisms. Actions taken to improve the performance of specific OFT devices are described. Author

N75-10916 Naval Missile Center, Point Mugu, Calif. Weapons Program Management Dept.
VTAS DT AND E PROGRAM **c09**
Otto A. Sanders and David R. Reed *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 30 p refs (For availability see N75-10910 02-05)

The characteristics of a visual target acquisition system (VTAS) are discussed. Plans for accomplishing the VTAS development, test, and evaluation program are analyzed. The program methodology involves conducting acceptance tests, laboratory tests, and ground/flight tests to collect data for determining the effectiveness and utility of each system. The specific applications of the VTAS are defined. The equipment used in conducting the evaluations is described. Advantages and disadvantages of various systems are reported. Author

N75-10917 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INTEGRATED AVIONICS: CONTROLS AND DISPLAYS FOR HELICOPTER IFR OPERATION **c06**
F. J. Winter, Jr. *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p refs (For availability see N75-10910 02-05)

A flight research effort has been established to investigate all aspects of helicopter instrument flight rule (IFR) operations ranging from lift-off, transition to cruise, approach, hover, and landing. The basic purpose is to evaluate recent developments in rotary wing instrument flight capability. These developments center around vehicle controllability through both control/display and stability augmentation systems. The configuration to be first evaluated was designed from the results documented by actual pilot performance during typical rotary wing IFR maneuvers. The maneuver profiles were designed and flown to record pilot activity and aircraft attitude. Several subject pilots flew the designed profiles to establish in what areas improvements were required. Each pilot's performance was then computerized to create a mean value of pilot ability to perform prescribed tasks. The analysis of the data gathered determined in what areas pilot performance could most likely be improved through refined helicopter controls and displays. Author

N75-10918 McDonnell-Douglas Corp., Edwards AFB, Calif.
MODE
C. E. Chisolm *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 19 p (For availability see N75-10910 02-05)

The F-15 Weapon Delivery Systems, its design concepts and the AIM-7F Sparrow Missile are reported. Flight test objectives and test plan formulation for the evaluation and qualification test phases of the AIM-7F delivery modes are discussed. Intermediate objectives, and how they were achieved utilizing the instrumented captive missile, are established. Primary emphasis, oriented towards conduct of the evaluation test phase include airborne test profiles utilized in conjunction with the captive missile, and the extensive amount of ground based facilities and airborne equipment necessary for such testing. The requirements of the qualification phase are outlined with the development of a typical launch profile. Problems encountered, both technical and support equipment related, are reviewed. Author

N75-10919 Lockheed-Georgia Co., Marietta.
FLIGHT DEMONSTRATION OF THE FEASIBILITY OF A SCANNING BEAM MICROWAVE LANDING SYSTEM **c09**
David W. Faris *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 16 p (For availability see N75-10910 02-05)

The flight test program to demonstrate the feasibility of a Scanning Beam Microwave Landing System is reported. The reasons for the new landing system, the requirements, the technical concepts, and descriptions of the feasibility hardware are discussed. The preliminary results and conclusions of the flight test program are presented. Tests of the feasibility configurations were conducted in a mobile laboratory for the ground static tests and in a C-118 aircraft for the flight tests. Author

N75-10920 Sperry Phoenix Co., Ariz. Flight Systems.
AUTOMATED AVIONICS SYSTEM CHECKOUT AND MONITORING IN A FLIGHT TEST ENVIRONMENT **c09**
B. T. Devlin, D. C. Mossman, and H. R. Urling *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 16 p refs (For availability see N75-10910 02-05)

The use of a general purpose digital computer as the central element of an automatic flight guidance and control system to enhance flight test avionics checkout and maintenance is discussed. In addition to its guidance control function, the computer (1) acquires and stores signal and logic data from sensors, and (2) monitors received signals by means of comparison tests, validity checks, or application of reasonableness criteria. Since it has stored this data in memory, it is in a unique position to capitalize on data availability to perform a comprehensive test function by a small addition to the airborne program. In recent applications, including a flight test program in a current design wide-bodied commercial transport, central integrated test and automated maintenance management functions were implemented within the airborne flight guidance and control computer to exercise all equipment during preflight test, fault isolate and report failures in flight with alphanumeric messages, and store maintenance data. Author

N75-10921 Grumman Aerospace Corp., Bethpage, N.Y. Systems Flight Test Section.
AIRBORNE TESTING OF ADVANCED MULTISENSOR AIRCRAFT
Leon Chabot, Norbert Wengler, and Alex Mallow *In* Soc. of

Flight Test Engr. Advan. in Flight Test Eng. 1974 34 p (For availability see N75-10910 02-05)

The characteristics of electro-optical sensors used on attack aircraft are discussed. The typical sensors include the following: (1) forward looking infrared (FLIR) devices, (2) low light level television (LLTV) units, and (3) laser transmitters and receivers. Typical flight test objectives for these devices include measurement of resolution and sensitivity of the FLIR and LLTV, and measurement of range and range accuracy using the laser transceiver. The flight testing involves the use of special preliminary ground tests, complex instrumentation and data processing, special targetry, and appropriate flight techniques. A discussion of the relationship of the electro-optics to the overall system, as well as descriptions of the special electro-optical sensors is provided. Author

N75-10922 Computing Devices of Canada, Ltd., Ottawa (Ontario).
JET ENGINE THRUST MEASURING SYSTEM: AN ADVANCEMENT IN FLIGHT TEST ENGINEERING
J. A. Gravelle *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p ref (For availability see N75-10910 02-05)

The characteristics of a thrust measuring system based on engine gas pressure and air data computer measurements only are discussed. The system computes a reference gross thrust which is compared with the engine gross thrust. Thrust parameters are displayed on a cockpit instrument. Diagrams of the system are provided and flight test results for specific installations are reported. Author

N75-10923 Naval Missile Center, Point Mugu, Calif.
NAVAL MISSILE CENTER PHOTO DATA ANALYSIS OF STORE SEPARATION FILMS
G. F. Cooper and R. W. Kingery *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 24 p (For availability see N75-10910 02-05)

A method of store-separation analysis which uses the photo data analysis system (PDAS) and an IBM 7094 computer is discussed. The PDAS involves superposition of two images, (a flight test movie image of the separating store and an image of a scale model of the store) by video mixing. At superposition, the positional relationship of the store to its camera is proportional to that of the model and its camera. A six degree of freedom, operator controlled positioner orients the model in the field of view of its camera. High accuracy in position data extracted from the test is possible because many raster points are used in image superposition while the conventional system uses only a cross hair intersection point. Diagrams of the system are included. Results of tests on specific systems are provided. Author

N75-10924 Naval Air Test Center, Patuxent River, Md.
HIGH SINK-RATE LANDING TESTING OF NAVY AIRCRAFT
George E. Clarke *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 9 p (For availability see N75-10910 02-05)

A procedure for measuring the landing sink rate of military aircraft landing on aircraft carriers is described. The systems used are based on the following: (1) two systems use camera film to generate height-time plots which are analyzed for sink rate and sink acceleration data, (2) a downward looking Doppler radar mounted on the aircraft to generate quick-look data, and (3) a system which depends on timing the passage of two aircraft-mounted trihedral mirrors through a fan of light to measure the sink rate. The accuracies obtainable with the various systems are reported. A diagram of a typical test installation is provided. Author

N75-10925 Saab-Scania, Linkoping (Sweden).
A SAAB-SCANIA DEVELOPED METHOD FOR OBTAINING STABILITY DERIVATIVES FROM FLIGHT TESTS
Goesta Niss *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p (For availability see N75-10910 02-05)

A system for obtaining precise data on aircraft stability and control during flight tests is discussed. A diagram of the system and its components is provided. The techniques for correcting the data to obtain the desired degree of accuravy are analyzed. To prove the validity of the determination, a digital simulation in six degrees of freedom is used. In this simulation the directly measured control surface pulse is combined with trim values and derivatives from flight test to obtain a time history. The time history is then compared with the one directly measured in flight. A typical example of the analysis of an automatic pilot function is provided to show the steps involved in the procedure. Author

N75-10926 Rockwell International Corp., Los Angeles, Calif. Test and Evaluation Dept.
APPLICATION OF THE FAST FOURIER TRANSFORM TO GROUND VIBRATION TESTING, AND FLIGHT FLUTTER TESTING c09
Alexander MacKenzie *In* Soc. of Flight Test Eng. Advan. in Flight Test Eng. 1974 15 p refs (For availability see N75-10910 02-05)

Efforts to extend the application of the Fast Fourier Transform, into on-line analysis of Ground Vibration Testing and Flight Flutter Testing are reported. The identification of modal frequencies and damping from both steady and swept sinusoidal excitation is discussed, the capabilities and limitations of the method, and the requirements for structuring both the test method and data acquisition, to suit the technique. The technique is used during ground vibration testing in conjunction with steady sinusoidal excitation: (1) to analyze a large number of accelerometers on line; (2) check orthogonality, to correctly obtain modal purity; and finally to plot and tabulate the resulting mode shapes. In flight flutter testing the ability to analyze modal frequencies and damping from fairly rapid sweeps, with greater accuracy is provided and is intended virtually to eliminate the laborious dwells and decays which can consume so much flight time. Author

N75-10927 Naval Air Test Center, Patuxent River, Md. Flying Qualities and Performance Branch.
APPLICATION OF A REAL TIME PROCESSING SYSTEM FOR FLYING QUALITIES AND PERFORMANCE TESTING
David E. Bischoff *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 11 p refs (For availability see N75-10910 02-05)

A real-time telemetry processing system for safety of flight monitoring, real-time data acquisition and data reduction is discussed. This system is composed of telemetry decoding equipment, XEROX computers, cathode ray and Nixie tube displays, strip chart recorders and a hardcopy machine, allowing for integrated presentation and documentation of calculated and engineering unit data. Approximately one year of operating experience has exhibited both the system's advantages and shortcomings for flying qualities and performance testing during real-time, post flight and batch mode data reduction phases. It's usefulness is enhanced by its variability coupled with an associated simplicity of control, allowing for hands on control of data acquisition and reduction by the test project engineers. The potential exists for reduced data turn around time and increased quality of testing as improved system reliability can be demonstrated. Author

N75-10928 McDonnell-Douglas Corp., Long Beach, Calif.
EFFECTIVE DATA MONITORING DURING AIRPLANE FLYOVER NOISE TESTS
Ernest M. Lowder *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 6 p (For availability see N75-10910 02-05)

The parameters to be considered when conducting flyover tests to measure aircraft noise are discussed. The basic areas considered are: (1) the airplane/engine configuration, (2) airplane/engine performance, (3) flight procedures, (4) weather, (5) terrain, and (6) microphone installation. Emphasis is placed on noise recording validity monitoring and on-site records and measured-data displays. It is stated that adjustments to the planned data sample should be made on the basis of preliminary normalized data. Comprehensive data monitoring requires automated data normalization involving a near-real time flyover noise evaluation system. Author

N75-10929 Transportation Systems Center, Cambridge, Mass.
MONITORING THE MOVEMENT OF WAKE VORTICES AT KENNEDY AND STAPLETON AIRPORTS c09
James N. Hallock *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 6 p refs (For availability see N75-10910 02-05)

The characteristics of turbulent wakes developed by aircraft movement and the procedures for analyzing the extent and severity of aircraft wakes, especially in the terminal area, are discussed. The test equipment and data recording devices are described. The approaches to controlling aircraft wakes and reporting the existence of dangerous wake conditions are examined. Author

N75-10930* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HOT-WIRE ANEMOMETRY FOR IN-FLIGHT MEASUREMENT OF AIRCRAFT WAKE VORTICES

Robert A. Jacobsen *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p refs (For availability see N75-10910 02-05)

CSCL 01B

Investigations were conducted to determine the characteristics of aircraft wake vortices using hot-wire anemometry. The design features of the measuring technique and the operational experience with it are described. The difficulties involved in obtaining flight test measurements of wake vortices are examined. Three techniques for in-flight measurement of aircraft wake turbulence are explained. Flight test results obtained under specific conditions are presented. Author

N75-10931* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESULTS OF FULL-SCALE VORTEX ATTENUATION FLIGHT EXPERIMENTS

Earl C. Hastings, Jr. and Robert A. Champine *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 21 p refs (For availability see N75-10910 02-05)

Flight tests have been conducted to evaluate the effectiveness of a wing-tip vortex attenuating device, referred to herein as a spline. Vortex penetrations were made with a PA-28 behind a C-54 aircraft with and without wing-tip splines attached and the resultant rolling acceleration was measured and related to the roll acceleration capability of the PA-28. Tests were conducted over a range of separation distances from about 5 nautical miles to less than 1 n. mi. Preliminary results indicate that, with the splines installed, there was a significant reduction in the vortex-induced roll acceleration experienced by the PA-28 probe aircraft, and the distance at which the PA-28 roll control became ineffective was reduced from 2.5 n. mi. to less than 1 n. mi. Although splines significantly reduced the C-54 rate of climb, the rates available with four engines were acceptable for this test program. Splines did not introduce any noticeable change in the handling qualities of the C-54. Author

N75-10932 Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

US ARMY HELICOPTER ICING TESTS

Warren E. Griffith, II and Marvin L. Hanks *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 15 p refs (For availability see N75-10910 02-05)

Limited testing of Army helicopters has been conducted in both artificial and natural icing environments. To provide for artificial icing tests, a helicopter icing spray system was developed which has the capability of providing a closely controlled in-flight artificial icing environment. Natural icing tests were conducted to verify that artificial icing characteristics are representative of natural icing characteristics. The test technique utilized was a build-up program in accretion, static temperature, and accretion rate. Of the helicopters tested (UH-1H,AH-1G, AH-1Q, and CH-47C), general problem areas have been identified. Engine ice ingestion, rotor blade impact damage, degraded autorotational capability, high vibration levels due to asymmetric ice shedding, and restricted foward visibility are a few of these problem areas. A simple, low-cost solution to asymmetric ice shedding from rotor systems is urgently needed to give the helicopter an all-weather capability. Author

N75-10933*# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.

STATISTICAL ANALYSIS OF GENERAL AVIATION VG-VGH DATA

Larry E. Clay, Raymond L. Dickey, Martin S. Moran, Kenneth W. Payauys, and Thomas P. Severyn [1974] 134 p refs (Contract NAS1-12389)

(NASA-CR-132531) Avail: NTIS HC $5.75 CSCL 01B

To represent the loads spectra of general aviation aircraft operating in the Continental United States, VG and VGH data collected since 1963 in eight operational categories were processed and analyzed. Adequacy of data sample and current operational categories, and parameter distributions required for valid data extrapolation were studied along with envelopes of equal probability of exceeding the normal load factor (n sub z) versus airspeed xor gust and maneuver loads and the probability of exceeding current design maneuver, gust, and landing impact n sub z limits. The significant findings are included. Author

N75-10934*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OPERATING EXPERIENCES OF RETARDANT BOMBERS DURING FIREFIGHTING OPERATIONS

Joseph W. Jewel, Jr., Garland J. Morris, and Donald E. Avery Nov. 1974 23 p refs

(NASA-TM-X-72622) Avail: NTIS HC $3.25 CSCL 01C

Data are presented on operational practices and maneuver accelerations experienced by two Douglas DC-6B airplanes converted to retardant bombers and used in firefighting operations. The data cover two fire seasons in the mountainous regions of the northwestern United States. Author

N75-10935*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMPARISON OF THREE METHODS FOR CALCULATION OF HELICOPTER ROTOR BLADE LOADING AND STRESSES DUE TO STALL

Wayne Johnson Washington Nov. 1974 25 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TN-D-7833; A-5337) Avail: NTIS HC $3.25 CSCL 01B

A comparison is made of the results of three methods for calculating the effects of dynamic stall on the performance, airloads, and blade stresses of a helicopter rotor at high loading. The three dynamic-stall methods considered predict essentially the same performance and trim for the rotor. They give roughly the same mean bending moments, but the peak-to-peak torsion and bending moments differ by 25 to 40 percent, and there are differences in the details of the predicted blade motion and stresses. The latter are due to significant differences in the dynamic stall aerodynamic loads, particularly the aerodynamic pitch moment, predicted by the three methods. Author

N75-10936*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

A REMOTELY AUGMENTED VEHICLE APPROACH TO FLIGHT TESTING RPV CONTROL SYSTEMS

Dwain A. Deets and John W. Edwards Nov. 1974 26 p

(NASA-TM-X-56029; H-870) Avail: NTIS HC $3.75 CSCL 01C

A remotely augmented vehicle concept for flight testing advanced control systems was developed as an outgrowth of a remotely piloted research vehicle (RPV) program in which control laws are implemented through telemetry uplink and downlink data channels using a general purpose ground based digital computer which provides the control law computations. Some advantages of this approach are that the cost of one control system facility is spread over a number of RPV programs, and control laws can be changed quickly as required, without changing the flight hardware. The remotely augmented vehicle concept is described, and flight test results from a subscale F-15 program are discussed. Suggestions of how the concept could lead to more effective testing of RPV control system concepts, and how it is applicable to a military RPV reconnaissance mission are given. Author

N75-10937*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

A PASSIVE WINGTIP LOAD ALLEVIATION SYSTEM

Raymond B. Harlan and John J. Deyst Oct. 1974 11 p (Grant NGR-22-009-571)

(NASA-CR-140758) Avail: NTIS HC $3.25 CSCL 01C

A passive wingtip load alleviation system was devised, tested,

and analyzed for its effect on the reduction of structural deformations and the extension of flutter speed. The sensors responded to changes in angle of attack and vertical movement of the wingtip and were used to deflect a trailing edge flap to alleviate the induced loads. Author

N75-10938# Sandia Labs., Albuquerque, N.Mex.
APPLICATIONS OF DIGITAL SPECTRAL ANALYSIS AND FILTERING TO AERODYNAMIC TESTING
E. L. Clark, Jr. and R. H. Croll, Jr. [1974] 19 p Presented at the 8th Aerodynamic Testing Conf., Bethesda, Md., 8 Jul. 1974 Sponsored by AEC
(SLA-73-7048-A; Conf-740704-1) Avail: NTIS HC $3.25

Digital frequency analysis methods are presented along with aerodynamic testing applications. The Fourier Transform is discussed as the basis for frequency analysis. Other topics discussed include: data processing, digital spectral analysis, and digital filters. Test techniques that permit three degrees of angular freedom, and techniques for determining large amplitude dynamic stability characteristics of a high-finess-ratio body. It is shown that digital spectral analyses are useful tools in aerodynamic testing. F.O.S.

N75-10939# Army Aviation Systems Command, St. Louis, Mo.
EXECUTIVE SUMMARY REPORT: COMMAND STATISTICS AND EVIDENCED PROBLEMS Final Report
Jul. 1974 40 p
(AD-782990; USAAVSCOM-TR-74-26) Avail: NTIS CSCL 01/3

The Command Statistics and Evidenced Problem Summary is intended to be a brief but informative presentation of compiled statistics and significant observations for the CH-54A aircraft as it appears in the US Army inventory. The primary use of this report will be to serve the management level with a rapid summary of the CH-54A's usage, Reliability, Availability, and Maintainability characteristics, and the means of identifying and solving its problem areas. The Command Statistics and Evidenced Problem Summary is derived directly from the CH-54A Management Summary Report (MSR), dated 24 September 1973. The MSR should therefore be used as a reference document for a more detailed explanation of the data presented here in this summary. The other reports forming the total Executive Summary are the CH-54A Assessment and Comparative Fleet Evaluations and Quality and Command Programs Assessment. Author (GRA)

N75-10940# Lockheed-California Co., Burbank.
DEVELOPMENT AND EXPERIMENTAL VERIFICATION OF PROCEDURES TO DETERMINE NONLINEAR LOAD-DEFLECTION CHARACTERISTICS OF HELICOPTER SUBSTRUCTURES SUBJECTED TO CRASH FORCES. VOLUME 1: DEVELOPMENT OF SIMPLIFIED ANALYTICAL TECHNIQUES TO PREDICT TYPICAL HELICOPTER AIRFRAME CRUSHING CHARACTERISTICS AND THE FORMULATION OF DESIGN PROCEDURES Final Report
G. Wittlin and K. C. Park May 1974 251 p refs
(Contract DAAJ02-73-C-0051; DA Proj. 1F1-62205-AH-88)
(AD-784191; USAAMRDL-TR-74-12A-Vol-1) Avail: NTIS CSCL 01/3

The results of a study to develop simplified design procedures for determining nonlinear load-deflection characteristics for helicopter airframe structures are presented in a two-volume report. Volume one describes 60 technical reports and papers with regard to their applicability to crashworthiness analysis and designer-oriented procedures. Studies were made using an existing 31 lumped mass model of the UH-1H helicopter to determine the sensitivity of responses to changes in load-deflection representations. Twelve transmission pylon specimens were fabricated and static and dynamic tests were performed. (Modified author abstract) GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N75-10941*# United Air Lines, Inc., Chicago, Ill.
FLEET RETROFIT REPORT
30 Jul. 1973 22 p refs
(Contract NAS2-7208)
(NASA-CR-137586) Avail: NTIS HC $3.25 CSCL 01D

Flight tests are evaluated of an avionics system which aids the pilot in making two-segment approaches for noise abatement. The implications are discussed of equipping United's fleet of Boeing 727-200 aircraft with two-segment avionics for use down to Category 2 weather operating minima. The experience is reported of incorporating two-segment approach avionics systems on two different aircraft. The cost of installing dual two-segment approach systems is estimated to be $37,015 per aircraft, including parts, labor, and spares. This is based on the assumption that incremental out-of-service and training costs could be minimized by incorporating the system at airframe overhaul cycle and including training in regular recurrent training. Accelerating the modification schedule could add up to 50 percent to the modification costs. Recurring costs of maintenance of the installation are estimated to be of about the same magnitude as the potential recurrent financial benefits due to fuel savings. Author

N75-10942# Institute for Defense Analyses, Arlington, Va.
STANDARDIZATION OF AVIONICS INFORMATION SYSTEMS Final Report
Corlin O. Beum, Jr. and F. Levin 31 Aug. 1974 402 p refs Prepared in cooperation with System Development Corp., Santa Monica, Calif.
(Contract DAHC15-C-0200)
(AD-783063; SDC-TM-5159/000/00A) Avail: NTIS CSCL 09/2

The report presents the results of a study to select and recommend standardization concepts for Avionics Information Processing Systems for the 1980-1990 time periods. The results indicate that technology advances in the areas of digital electronics, large scale integrated circuits (LSI), and multiplexing support the thesis that avionic information processing hardware will become both highly reliable and very low in cost in the time periods being considered. This permits the avionic system designer to consider a highly distributed, dedicated digital system architecture which involves inefficient use of CPU time, memory, I/O buffers and redundancy to alleviate the growing cost, schedule and reliability problems in avionic systems software. (Modified author abstract) GRA

N75-10917 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INTEGRATED AVIONICS: CONTROLS AND DISPLAYS FOR HELICOPTER IFR OPERATION
F. J. Winter, Jr. *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p refs (For availability see N75-10910 02-05)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N75-10943*# Lockheed-California Co., Burbank.
ADVANCED SUPERSONIC TECHNOLOGY CONCEPT STUDY: HYDROGEN FUELED CONFIGURATION Final Report, Jul. - Dec. 1973
G. D. Brewer Jan. 1974 326 p refs
(Contract NAS2-7732)
(NASA-CR-114718; LR-26323) Avail: NTIS HC $9.50 CSCL 21D

Conceptual designs of hydrogen fueled supersonic transport configurations for the 1990 time period were developed and compared with equivalent technology Jet A-1 fueled vehicles to

determine the economic and performance potential of liquid hydrogen as an alternate fuel. Parametric evaluations of supersonic cruise vehicles with varying design and transport mission characteristics established the basis for selecting a preferred configuration which was then studied in greater detail. An assessment was made of the general viability of the selected concept including an evaluation of costs and environmental considerations, i.e., exhaust emissions and sonic boom characteristics. Technology development requirements and suggested implementation schedules are presented. Author

N75-10944*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE FAN. 2: DATA AND PERFORMANCE WITH REDESIGNED SECOND STAGE ROTOR UNIFORM AND DISTORTED INLET FLOWS
H. E. Messenger and M. J. Keenan Oct. 1974 352 p refs
(Contract NAS3-13494)
(NASA-CR-134710; PWA-5087) Avail: NTIS HC $10.00 CSCL 21E

A two-stage fan with a first rotor tip speed of 1450 ft/sec (441.96 m/sec) and no inlet guide vanes was tested with uniform and distorted inlet flows, with a redesigned second rotor having a part span shroud to prevent flutter, with variable-stagger stators set in nominal positions, and without rotor casing treatment. The fan achieved a pressure ratio 2.8 at a corrected flow of 185.4 lbm/sec (84.0 kg/sec), an adiabatic efficiency of 85.0 percent, and a stall margin of 12 percent. The redesigned second rotor did not flutter. Tip radial distortion reduced the stall margin at intermediate speed, but had little effect on stall margin at high or low speeds. Hub radial distortion reduced the stall margin at design speed but increased stall margin at low speed. Circumferential distortion reduced stall pressure ratio and flow to give approximately the same stall lines with uniform inlet flow. Distortions were attenuated by the fan. For Vol. 1, see N74-11421. Author

N75-10945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF OPTIMUM JP AND LH2 TURBOFAN ENGINES DESIGNED FOR TWO SUBSONIC TRANSPORT MISSIONS
Kestutis C. Civinskas Oct. 1974 48 p refs
(NASA-TM-X-71622; E-8145) Avail: NTIS HC $3.75 CSCL 21E

The use of liquid hydrogen fuel instead of JP fuel for two subsonic commercial transports was examined. The following determinations which are important to meeting noise reduction requirements were calculated: (1) take off gross weight, (2) energy consumption, and (3) direct operating costs. The optimum engine cycles were found to be the same for both fuels. Author

N75-10946# Brussels Univ. (Belgium). Dept. of Fluid Mechanics.
A FINITE ELEMENT METHOD FOR FLOW CALCULATIONS IN TURBOMACHINES
C. Hirsch and G. Warzee Jul. 1974 76 p refs
(VUB-STR-5) Avail: NTIS HC $4.75 CSCL 21E

The pitch-averaged equations in a meridional plane of a turbomachine are derived from the general flow equations. Assuming axisymmetry, these equations are solved, in the case of axial compressors, with the finite element method. The finite element method and the calculation procedure are described. The method is limited to subsonic meridional velocities allowing the treatment of transonic stages. Comparisons with experimental results for a transonic single compressor stage and a subsonic 6-stage axial compressor show excellent agreement. Author

N75-10947*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SINGLE-STAGE EXPERIMENTAL EVALUATION OF TANDEM-AIRFOIL ROTOR AND STATOR BLADING FOR COMPRESSORS, PART 8 Final Report
J. A. Brent and D. R. Clemmons Nov. 1974 99 p refs
(Contract NAS3-11158)
(NASA-CR-134713; FR-6247-Pt-8) Avail: NTIS HC $4.75 CSCL 21E

An experimental investigation was conducted with an 0.8 hub/tip ratio, single-stage, axial flow compressor to determine the potential of tandem-airfoil blading for improving the efficiency and stable operating range of compressor stages. The investigation included testing of a baseline stage with single-airfoil blading and two tandem-blade stages. The overall performance of the baseline stage and the tandem-blade stage with a 20-80% loading split was considerably below the design prediction. The other tandem-blade stage, which had a rotor with a 50-50% loading split, came within 4.5% of the design pressure rise (delta P(bar)/P(bar) sub 1) and matched the design stage efficiency. The baseline stage with single-airfoil blading, which was designed to account for the actual rotor inlet velocity profile and the effects of axial velocity ratio and secondary flow, achieved the design predicted performance. The corresponding tandem-blade stage (50-50% loading split in both blade rows) slightly exceeded the design pressure rise but was 1.5 percentage points low in efficiency. The tandem rotors tested during both phases demonstrated higher pressure rise and efficiency than the corresponding single-airfoil rotor, with identical inlet and exit airfoil angles. Author

N75-10948*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE OF MODEL TARGET TYPE THRUST REVERSERS FOR ENGINE-OVER-THE-WING APPLICATIONS
James R. Stone and Orlando A. Gutierrez 1974 24 p refs Presented at the 88th Meeting of the Acoust. Soc. of Am., St. Louis, 5-8 Nov. 1974
(NASA-TM-X-71621; E-8142) Avail: NTIS HC $3.25 CSCL 01C

The results of experiments on the noise generated by V-gutter and semicylindrical target reversers with circular and short-aspect-ratio slot nozzles having diameters of about 5 cm are presented. The experiments were conducted with cold-flow jets at velocities from 190-290 m/sec. The reversers at subsonic jet velocities had a more uniform noise distribution and higher frequency than the nozzles alone. The reverser shape was shown to be more important than the nozzle shape in determining the noise characteristics. The maximum sideline pressure level varied with the sixth power of the jet velocity, and the data were correlated for angles along the sideline. An estimate of the noise level along the 152 m sideline for an engine-over-the-wing powered-lift airplane was made. Author

N75-10949# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
SIMULATION OF TRIPLE-SPOOL TURBOFAN ENGINE Final Report
Edward K. Norvaisis Apr. 1974 155 p refs
(AD-784771; AFAPL-TR-74-13) Avail: NTIS CSCL 21/5

This report describes a digital computer program entitled TRISPL. TRISPL is a computer program that simulates steady-state design and off-design performance of triple-spool turbofan engines. The program has been formulated for an engine type with two core spools and one fan spool but can easily be modified for other engine types (two fan spools and one core spool, for example). The program, written in FORTRAN 4 language, uses performance maps (in Block Data format) of the major engine components. Information on setting up the block data and input data is given in the report. Also included is a complete program listing with a description of each subroutine and sample results. Author (GRA)

N75-10950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JET COOLING OF THE LEADING EDGE OF A TURBINE BLADE
A. I. Mazur and V. E. Filipchuk 17 Jul. 1974 9 p refs Transl. into ENGLISH from Vop. Tekhn. Teplofiz. (USSR), no. 3, 1971 p 69-72
(AD-784015; FTD-HT-23-1820-74) Avail: NTIS CSCL 21/5

One of the effective methods of the cooling of the leading edge of a turbine blade is jet blowing. In the reported experiments the object of the investigation was the model of a working blade made in a 5:1 scale with a chord of 60 mm. Parameters of the investigated system of jets were varied by means of an interchangeable nozzle part installed onto a permanent deflector. GRA

N75-10951# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
COMBUSTOR MODELLING Final Report
I. Poll, R. Payne, J. Swithenbank, and M. W. Vincent Mar. 1974 16 p refs Presented at the 2d Intern. Symp. on Air Breathing Engines, Sheffield, Engl., Mar. 1974
(Grant AF-AFOSR-2248-72; AF Proj. 9711)
(AD-784906; AFOSR-74-1422TR) Avail: NTIS CSCL 21/2

A modelling procedure is presented for the prediction of gas turbine combustor performance. The individual processes of fuel-spray evaporation, homogeneous turbulent mixing, and chemical reaction are combined by means of a partially stirred chemical reactor sequence representing the internal mean flow pattern derived from the geometry of a given combustor. Subsequent tests on the combustor showed satisfactory agreement between experimental and theoretical combustion extinction limits over a wide range of combustor loading. Since the reactor sequence depends on the geometry (and is, for example, independent of fuel/air ratio) these results give confidence that this modelling technique can be applied at all normal operating conditions. Author (GRA)

N75-11035 General Electric Co., Cincinnati, Ohio.
REQUIREMENTS FOR AND CHARATERISTICS DEMANDED OF HIGH TEMPERAURE GAS TURBINE COMPONENTS
L. P. Jahnke and C. A. Bruch *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 3-12 refs (For availability see N75-11034 02-24)

N75-10922 Computing Devices of Canada, Ltd., Ottawa (Ontario).
A NEW JET ENGINE THRUST MEASURING SYSTEM: AN ADVANCEMENT IN FLIGHT TEST ENGINEERING
J. A. Gravelle *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p ref (For availability see N75-10910 02-05)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N75-10952*# Stanford Univ., Calif. Guidance and Control Lab.
SELECTION OF SAMPLING RATE FOR DIGITAL CONTROL OF AIRCRAFTS
Paul Katz and J. David Powell Sep. 1974 243 p refs Sponsored in part by Govt. of Israel
(Grant NsG-4002)
(NASA-CR-140759; SU-DAAR-486) Avail: NTIS HC $7.50 CSCL 01C

The vonsiderations in selecting the sample rates for digital control of aircrafts are identified and evaluated using the optimal discrete method. A high performance aircraft model which includes a bending mode and wind gusts was studied. The following factors which influence the selection of the sampling rates were identified: (1) the time and roughness response to control inputs; (2) the response to external disturbances; and (3) the sensitivity to variations of parameters. It was found that the time response to a control input and the response to external disturbances limit the selection of the sampling rate. The optimal discrete regulator, the steady state Kalman filter, and the mean response to external disturbances are calculated. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N75-10953*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY ENGINEERING CONCEPTS/DESIGN TRADEOFFS. VOLUME 1: STUDY RESULTS Final Report, Jan. - Oct. 1974
R. V. Greco, L. R. Eaton, and H. C. Wilkinson Sep. 1974 513 p refs 2 Vol.
(Contract NAS8-30272)
(NASA-CR-120500; MDC-G-5447-Vol-1) Avail: NTIS HC $12.25 CSCL 14B

The work is summarized which was accomplished from January 1974 to October 1974 for the Zero-Gravity Atmospheric Cloud Physics Laboratory. The definition and development of an atmospheric cloud physics laboratory and the selection and delineation of candidate experiments that require the unique environment of zero gravity or near zero gravity are reported. The experiment program and the laboratory concept for a Spacelab payload to perform cloud microphysics research are defined. This multimission laboratory is planned to be available to the entire scientific community to utilize in furthering the basic understanding of cloud microphysical processes and phenomenon, thereby contributing to improved weather prediction and ultimately to provide beneficial weather control and modification. Author

N75-10954*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
ZERO-GRAVITY ATMOSPHERIC CLOUD PHYSICS EXPERIMENT LABORATORY-ENGINEERING CONCEPTS/DESIGN TRADEOFFS. VOLUME 2: DETAILED APPROACHES Final Report, Jan. - Oct. 1974
R. V. Greco, L. R. Eaton, and H. C. Wilkinson Sep. 1974 519 p refs 2 Vol.
(Contract NAS8-30272)
(NASA-CR-120501; MDC-G5447-Vol-2) Avail: NTIS HC $12.25 CSCL 14B

For abstract, see N75-10953.

N75-10955# California Univ., Livermore. Lawrence Livermore Lab.
DEVIATION FROM FLAT IMPACT WITH LLL'S TWO-STAGE LIGHT GAS GUN DUE TO PROJECTILE TILTING AND DISTORTION
A. C. Mitchell and B. L. Hord 22 Mar. 1974 13 p refs
(Contract W-7405-eng-48)
(UCID-16468) Avail: NTIS HC $3.25

The two-stage light gas gun at LLL is designed to produce a flat impact between the planar surfaces of the accelerated projectile (impactor plate) and a stationary target. Tilt and surface distortion of the projectile cause some deviation from a flat impact, with corresponding variations in impact time from one point to another on the impacting surfaces. Point-to-point variations in impact time were measured for impactor plates accelerated to a velocity of 7 mm/usec, near the gun's top velocity. The time variations due to surface distortion were within about + or - 3 nsec, and those due to tilt of the projectile were within + or - 20 nsec, across a central 1.8-cm diameter of the 2.4-cm-diam impactor plate. Author

N75-10956# Sandia Labs., Albuquerque, N.Mex.
ELECTRIC HEATER DEVELOPMENT FOR A HIGH PERFORMANCE MACH NUMBER 14 WIND TUNNEL
C. W. Peterson, J. F. Reed, and W. H. Curry [1974] 37 p refs Presented at the 8th Aerodynamic Testing Conf., Bethesda, Md., 8 Jul. 1974 Sponsored by AEC
(SLA-73-7082; Conf-740704-2) Avail: NTIS HC $3.75

A high pressure Mach number 14 testing capability was added to the Sandia Laboratories hypersonic wind tunnel facility.

Of particular significance is the new electric heater which was developed for this addition. It can deliver up to one-megawatt of power to the test gas at pressures as high as 2000 N/sq cm(2900 psia) for a sixty second run. Stagnation temperatures to 1400 K(2500 R) are achieved. Pressure and temperature calibrations show that the flow in the tunnel test section is satisfactory for research and development experimentation.
Author

N75-10957# Little (Arthur D.), Inc., Cambridge, Mass.
EVALUATION OF AUXILIARY AGENTS AND SYSTEMS FOR AIRCRAFT GROUND FIRE SUPPRESSION, PHASE 2 Final Report, 9 Aug. 1972 - 10 Dec. 1973
Sami Atallah and R. Scott Stricoff May 1974 116 p refs
(Contract F33657-72-C-0422)
(AD-784924; ADL-C-74159-2; ASD-TR-73-41) Avail: NTIS CSCL 13/12

An experimental program was conducted to assess the capabilities of three extinguishing agents under similar fire test conditions. The agents tested were a carbamic powder (CP), halon 1211, and an experimental modification of potassium bicarbonate (PKX). Tests were first conducted to select appropriate nozzles and operating pressures for PKX portable and wheeled extinguishers and halon 1211 portable units. The operating characteristics of portable and wheeled units for all three agents tested are provided. Fire extinguishing tests were next conducted on reproducible configurations simulating interior and exterior aircraft fire conditions. Interior fires included electrical fires, compartment fires involving various individual and mixed fuels and hidden oil fires. Exterior fires included those occurring in helicopter engine stacks, engine nacelles, the reticulated foam of some aircraft tanks, and those involving fuel burning on aircraft wings and cascading fuel fires. (Modified author abstract) GRA

N75-10958# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SKID RESISTANCE TESTS IN SUPPORT OF THE F-4 RAIN TIRE PROGRAM AT THE AIR FORCE FLIGHT TEST CENTER Final Report, Mar. - Aug. 1973
Phil V. Compton Jun. 1974 161 p
(AF Proj. 683M)
(AD-784801; AFWL-TR-74-90) Avail: NTIS CSCL 01/5

A summary of the significant test results from the skid-resistance test program conducted to support the F-4 rain tire program is presented. Testing was conducted with both the mu meter and diagonally braked vehicle (DBV). The results of the testing indicated that the traction properties generally decrease toward the touchdown end of the 8000-foot aircraft test area. This was a result of the water being applied in a direction toward the touchdown end of the test section. A potential for hydroplaning does exist in these ranges of skid-resistance values, and the wet conditions present during the F-4 rain tire program are considered representative of a potential hazardous runway condition. (Modified author abstract) GRA

N75-10959# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
EVALUATION OF CONSTRUCTION TECHNIQUES FOR NEW ANTIHYDROPLANING OVERLAYS Final Report, Feb. 1973 - Feb. 1974
Emil R. Hargett Jun. 1974 58 p
(Contract F29601-74-C-0030; AF Proj. 683M)
(AD-784870; AFWL-TR-74-77) Avail: NTIS CSCL 01/5

Runway surfaces that will prevent hydroplaning of highspeed jet aircraft during wet weather operations have become a primary requisite for airfields operated by the Air Force and the civilian aviation community. This report describes the materials, construction techniques, and results obtained from a program of field testing addressed to the need for antihydroplaning surfaces. The materials selected for field testing consisted of friction-textured asphalt slurry, Palmer-Pavetread, porous asphalt cold mix, porous asphalt hot mix with latex rubber, and a porous aggregate structure with a resinous binder (Bondate). The construction of test surfaces from these materials, with the exception of Bondate, are described. Special emphasis is given to the construction techniques and construction problems associated with the use of the new materialsj (Modified author abstract) GRA

N75-10960# Illinois Univ., Savoy. Aviation Research Lab.
USES OF A VISUAL LANDING SYSTEM IN PRIMARY FLIGHT TRAINING
Linda L. Young, Richard S. Jensen, and Curtis W. Traiche Oct. 1973 10 p refs Presented at the 17th Ann. Meeting of the Human Factors Soc., Washington, D. C., 16-18 Oct. 1973
(Contract F44620-70-C-0105; AF Proj. 9778)
(AD-784888; ARL-73-26/AFOSR-73-17; AFOSR-74-1350TR)
Avail: NTIS CSCL 05/9

An exploratory study was made to determine the potential usefulness of a visual landing system in a primary flight training program and to determine design and instructional changes which may be necessary to optimize the landing trainer. Thirty-eight flight-naive student-subjects were divided into three groups, each receiving a different type of simulator landing instruction: Visual Landing System (VLS), Standard GAT-1 (SG), and Control (C). The criterion was three consecutive unassisted landings in a Cherokee 140. The primary measure was flight instruction time needed to reach criterion. Comments from flight instructors and students demonstrated an attitude of high optimism concerning the potential of the VLS as an aid to teaching landings. (Modified author abstract) GRA

N75-10961# Factory Mutual Research Corp., Norwood, Mass.
FIRE PROTECTION OF LARGE AIR FORCE HANGARS Final Report, Dec. 1972 - Apr. 1974
L. M. Krasner, P. J. Chicarello, and P. M. Fitzgerald Jul. 1974 41 p refs
(Contract F29601-73-C-0043; AF Proj. 683K)
(AD-784869; AFWL-TR-74-23) Avail: NTIS CSCL 13/12

The report describes a study dealing with the fire protection of large Air Force hangars. The text includes discussion of aircraft tolerance to fire exposure (by both direct flame impingement and radiative and convective heat transfer), detection systems for primary and supplementary system actuation in hangars, oscillating monitor nozzles for ground level protection in hangars, and testing of several foam agents in combination with several types of discharge devices suitable for deluge systems. The emphasis of the study was on the test program. A series of non-fire foam quality tests were conducted as well as 900 sq ft JP-4 fire tests discharging Aqueous Film - Forming Foam (AFFF) as the suppressing agent from a deluge system located 60 ft above the fuel surface. (Modified author abstract) GRA

N75-10913 Naval Missile Center, Point Mugu, Calif. Planning and Resources Management Office.
ADVANCEMENTS IN THE TEST AND EVALUATION OF NAVAL WEAPONS SYSTEMS
Thaddeus P. Perry and Robert J. Warnagieris *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 13 p (For availability see N75-10910 02-05)

N75-10914 Naval Air Development Center, Warminster, Pa.
THE R AND D SIMULATOR: A NEW T AND E TOOL
Robert L. Fortenbaugh *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 18 p refs (For availability see N75-10910 02-05)

N75-10915 Naval Air Test Center, Patuxent River, Md. Flying Qualities and Performance Branch.
FLIGHT FIDELITY TESTING OF US NAVY OPERATIONAL FLIGHT TRAINERS
R. Thomas Galloway *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 12 p (For availability see N75-10910 02-05)

N75-10916 Naval Missile Center, Point Mugu, Calif. Weapons Program Management Dept.
VTAS DT AND E PROGRAM
Otto A. Sanders and David R. Reed *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 30 p refs (For availability see N75-10910 02-05)

N75-10919 Lockheed-Georgia Co., Marietta.
FLIGHT DEMONSTRATION OF THE FEASIBILITY OF A SCANNING BEAM MICROWAVE LANDING SYSTEM
David W. Faris *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 16 p (For availability see N75-10910 02-05)

N75-10920 Sperry Phoenix Co., Ariz. Flight Systems.
AUTOMATED AVIONICS SYSTEM CHECKOUT AND MONITORING IN A FLIGHT TEST ENVIRONMENT
B. T. Devlin, D. C. Mossman, and H. R. Urling *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 16 p refs (For availability see N75-10910 02-05)

N75-10926 Rockwell International Corp., Los Angeles, Calif. Test and Evaluation Dept.
APPLICATION OF THE FAST FOURIER TRANSFORM TO GROUND VIBRATION TESTING, AND FLIGHT FLUTTER TESTING
Alexander MacKenzie *In* Soc. of Flight Test Eng. Advan. in Flight Test Eng. 1974 15 p refs (For availability see N75-10910 02-05)

N75-10929 Transportation Systems Center, Cambridge, Mass.
MONITORING THE MOVEMENT OF WAKE VORTICES AT KENNEDY AND STAPLETON AIRPORTS
James N. Hallock *In* Soc. of Flight Test Engr. Advan. in Flight Test Eng. 1974 6 p refs (For availability see N75-10910 02-05)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N75-10962*# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
DISCIPLINE REPORT ON THERMAL ANALYSES OF M551, M552, AND M553 EXPERIMENTS
T. Muraki and K. Masubuchi Nov. 1974 84 p refs
(Contract NAS8-28732)
(NASA-CR-120513) Avail: NTIS HC $4.75 CSCL 13H

Reduced gravity does not significantly affect the thermal histories in the M551 specimen, even if molten metal flow pattern is different from that in terrestrial conditions. Thermal histories corresponding to terrestrial experimental conditions were calculated by use of the computer programs. Heat conduction through brazing alloy (M552 experiment) is improved in the Skylab conditions, because of the increased extent, rate and uniformity of braze spreading in space. Effects of reduced gravity on heat flow in the M553 specimen are insignificant, because convection effects appear instantaneously and conduction is a governing factor on the heat flow. Author

N75-10963*# Oak Ridge National Lab., Tenn.
RADIOISOTOPE TRACER STUDIES IN THE NASA SKYLAB ETHOTHERMIC BRAZING EXPERIMENT M-552
D. N. Braski, H. L. Adair, and E. H. Kobisk Sep. 1974 53 p refs Sponsored by NASA
(Contract W-7405-eng-26)
(NASA-CR-129035) Avail: NTIS HC $4.25 CSCL 13H

The first use of radioisotope tracer for mapping flow patterns during brazing of metal components in a space environment (near-zero gravity) proved successful. A nickel ferrule was brazed to a nickel tube with Lithobraze BT (71.8% Ag, 28% Cu, 0.2% Li) which contained a trace amount of radioactive Ag-110. Mapping of the flow of the braze alloy in the annulus formed between the tube and the concentric ferrule was determined by counting the radiation intensity as a function of position in the braze joint. Significant information concerning the thermal history of the braze was determined. Author

N75-10964*# Scientific Translation Service, Santa Barbara, Calif.
THE EARTH IN THE LENS OF SALYUT-3
V. Ivanov Washington NASA Nov. 1974 13 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 9, Sep. 1974 p 38-40
(Contract NASw-2483)
(NASA-TT-F-16028) Avail: NTIS HC $3.25 CSCL 22C

Experiments performed by the cosmonauts on Salyut-3 and Soyuz-14 are described. The geological-morphological objects on the earth, as well as atmospheric formations and phenomena, were studied. It is concluded that this work represents one of the first steps in the conquest of space. Author

N75-10965*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THE ROLE OF FLIGHT MISSION RULES IN MISSION PREPARATION AND CONDUCT
Larry W. Keyser Washington Nov. 1974 10 p
(NASA-TN-D-7822; JSC-S-417) Avail: NTIS HC $3.25 CSCL 22A

The development of flight mission rules from the mission development phase through the detailed mission-planning phase and through the testing and training phase is analyzed. The procedure for review of the rules and the coordination requirements for mission-rule development are presented. The application of the rules to real-time decision making is outlined, and consideration is given to the benefit of training ground controllers and flightcrews in the methods of determining the best response to a nonnominal in-flight situation for which no action has been preplanned. The Flight Mission Rules document is discussed in terms of the purpose and objective thereof and in terms of the definition, the development, and the use of mission rules. Author

N75-10966*# Massachusetts Inst. of Tech., Cambridge.
THERMAL ANALYSIS OF M551 EXPERIMENT FOR MATERIALS PROCESSING IN SPACE Final Report
T. Muraki and K. Masubuchi Nov. 1974 50 p refs
(Contract NAS8-28732)
(NASA-CR-120517) Avail: NTIS HC $3.75 CSCL 13H

Heat flow in a disc due to moving heat generated by electron beam was studied analytically. Computer programs based on the finite-element method were developed for the analysis of two and three dimensional mathematical models. The limited experimental data were compared with the analytical results, and factors which had influence on heat flow in the disc were studied. The computer programs were modified to consider the effects of metal melting and solidification as well as radiation. Temperature dependency of thermophysical properties was also considered. Author

N75-10967*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC INTEGRATED EXPERIMENTS PRELIMINARY REPORT
Nov. 1974 146 p refs
(NASA-TM-X-64881) Avail: NTIS HC $5.75 CSCL 22C

Skylab experiments are described and their preliminary results are reported. The types of experiments described include medical, earth resources, space physics, space manufacturing, and spacecraft design. Author

N75-10968*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SKYLAB STRUCTURES AND MECHANICAL SYSTEMS MISSION EVALUATION
Oct. 1974 348 p
(NASA-TM-X-64824) Avail: NTIS HC $9.50 CSCL 22C

A performance analysis for structural and mechanical major hardware systems and components is presented. Development background testing, modifications, and requirement adjustments are included. Functional narratives are provided for comparison purposes as are predicted design performance criterion. Each item is evaluated on an individual basis: that is, (1) history (requirements, design, manufacture, and test); (2) in-orbit performance (description and analysis); and (3) conclusions and recommendations regarding future space hardware application. Overall, the structural and mechanical performance of the Skylab hardware was outstanding. Author

N75-10969*# Wisconsin Univ., Madison. Dept. of Metallurgical and Mineral Engineering.
FLIGHT/GROUND SAMPLE COMPARISON RELATING TO FLIGHT EXPERIMENT M552, EXOTHERMIC BRAZING
Richard W. Heine, Clyde M. Adams, and Thomas A. Siewert Dec. 1973 40 p refs
(Contract NAS8-28733)
(NASA-CR-120509) Avail: NTIS HC $3.75 CSCL 13H

Comparisons were made between Skylab and ground-based specimens of nickel and stainless steel which were vacuum brazed

using silver-copper-lithium alloy with various joint configurations. It was established that the absence of gravity greatly extends the scope of brazing since capillary flow can proceed without gravity interference. There was also evidence of enhanced transport, primarily in that liquid silver copper alloy dissolves nickel to a much greater extent in the zero gravity environment. Author

N75-10970*# Oak Ridge National Lab., Tenn.
PREPARATION, TESTING AND ANALYSIS OF ZINC DIFFUSION SAMPLES, NASA SKYLAB EXPERIMENT M-558
D. N. Braski, E. H. Kobisk, and F. R. ODonnell Apr. 1974 60 p refs Sponsored in part by NASA
(Contract W-7405-eng-26)
(NASA-CR-140789; ORNL-4956) Avail: NTIS HC $4.25 CSCL 13H

Transport mechanisms of zinc atoms in molten zinc were investigated by radiotracer techniques in unit and in near-zero gravity environments. Each melt in the Skylab flight experiments was maintained in a thermal gradient of 420 C to 790 C. Similar tests were performed in a unit gravity environment for comparison. After melting in the gradient furnace followed by a thermal soak period (the latter was used for flight samples only), the samples were cooled and analyzed for Zn-65 distribution. All samples melted in a unit gravity environment were found to have uniform Zn-65 distribution - no concentration gradient was observed even when the sample was brought rapidly to melting and then quenched. Space-melted samples, however, showed textbook distributions, obviously the result of diffusion. It was evident that convection phenomena were the dominant factors influencing zinc transport in unit gravity experiments, while diffusion was the dominant factor in near-zero gravity experiments. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N75-10971*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHARACTERISTICS OF COUPLED NONGRAY RADIATING GAS FLOWS WITH ABLATION PRODUCT EFFECTS ABOUT BLUNT BODIES DURING PLANETARY ENTRIES Ph.D. Thesis - North Carolina State Univ.
Kenneth Sutton 1973 181 p refs
(NASA-TM-X-72078) Avail: NTIS HC $7.00 CSCL 22C

A computational method was developed for the fully-coupled solution of nongray, radiating gas flows with ablation product effects about blunt bodies during planetary entries. The treatment of radiation accounts for molecular band, continuum, and atomic line transitions with a detailed frequency dependence of the absorption coefficient. The ablation of the entry body was solved as part of the solution for a steady-state ablation process. The method was applied by results at typical conditions during entry to Venus. The radiative heating rates along the downstream region of the body can exceed the stagnation point value. The radiative heating to the body is attenuated in the boundary layer at the downstream region of the body and at the stagnation point of the body. A study of the radiation, inviscid flow about spherically capped, conical bodies during planetary entries shows that the nondimensional, radiative heating distributions are nonsimilar with entry conditions. Caution should be exercised in attempting to extrapolate results from known distributions to other entry conditions for which solutions have not yet been obtained. Author

N75-10972*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
A GUIDANCE AND NAVIGATION SYSTEM FOR CONTINUOUS LOW-THRUST VEHICLES M.S. Thesis
Charles Jack-ChingTse Sep. 1973 94 p refs
(Grant NGR-22-009-207)
(NASA-CR-139146) Avail: NTIS HC $4.75 CSCL 17G

A midcourse guidance and navigation system for continuous low thrust vehicles was developed. The equinoctial elements are the state variables. Uncertainties are modelled statistically by random vector and stochastic processes. The motion of the vehicle and the measurements are described by nonlinear stochastic differential and difference equations respectively. A minimum time trajectory is defined; equations of motion and measurements are linearized about this trajectory. An exponential cost criterion is constructed and a linear feedback quidance law is derived. An extended Kalman filter is used for state estimation. A short mission using this system is simulated. It is indicated that this system is efficient for short missions, but longer missions require accurate trajectory and ground based measurements. Author

N75-10973*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
NUMERICAL ORBIT INTEGRATION EFFICIENCY OF THE DELAUNAY-SIMILAR ELEMENTS
Sam Pierce 15 Oct. 1974 53 p refs
(Contract NAS7-100; Grant NGR-05-071-005)
(NASA-CR-140768; JPL-TM-33-710) Avail: NTIS HC $4.25 CSCL 22A

Orbit equations with a set of conservative and a set of nonconservative perturbing potentials were considered. Scheifele's DS formulation of these equations has dependent variables similar to Delaunay's orbital elements with the true anomaly as the independent variable. Efficiency curves of computing cost v.s. accuracy were constructed for Adams integrators of order of 2 through 15 with several correcting algorithms and for a Runga-Kutta integrator. Considering stability regions, choices were made for the optimally efficient integration modes for the DS elements. Integrating in these modes reduces computing costs for a specified accuracy. Author

N75-10974*# Wolf Research and Development Corp., Riverdale, Md.
GEODYN PROGRAMMERS GUIDE, VOLUME 2, PART 1 Final Report
N. E. Mullins, C. C. Goad, N. C. Dao, T. V. Martin, N. L. Boulware, and M. M. Chin Oct. 1972 367 p 4 Vol.
(Contract NAS5-11735)
(NASA-CR-139150) Avail: NTIS HC $10.00 CSCL 22A

A guide to the GEODYN Program is presented. The program estimates orbit and geodetic parameters. It possesses the capability to estimate that set of orbital elements, station positions, measurement biases, and a set of force model parameters such that the orbital tracking data from multiple arcs of multiple satellites best fit the entire set of estimated parameters. GEODYN consists of 113 different program segments, including the main program, subroutines, functions, and block data routines. All are in G or H level FORTRAN and are currently operational on GSFC's IBM 360/95 and IBM 360/91. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N75-10975*# National Aeronautics and Space Administration, Washington, D.C.

PROJECT HELIOS-A
25 Nov. 1974 45 p
(NASA-News-Release-74-314) Avail: NASA Scientific and Technical Information Facility P. O. Box 33, College Park, Maryland 20740 CSCL 22B

The Helios-A solar probe which will fly within 28 million miles of the sun is described as a joint American and German project. The spacecraft and instrument designs, planned experiments, and mission are briefly discussed. F.O.S.

N75-10976*# New Hampshire Univ., Durham. Dept. of Physics.
ATION OF THE DATA ANALYSIS SYSTEM FOR THE GAMMA RAY MONITOR ABOARD OSO-H Final Project Report
S. Croteau, A. Buck, P. Higbie, J. Kantauskis, S. Foss, D. Chupp, D. Forrest, A. Suri, and I. Gleske Dec. 1973 369 p
(Contract NAS5-11054)
(NASA-CR-139147) Avail: NTIS HC $10.00 CSCL 05B

The programming system is presented which was developed to prepare the data from the gamma ray monitor on OSO-7 for scientific analysis. The detector, data, and objectives are described in detail. Programs presented include: FEEDER, PASS-1, CAL1, CAL2, PASS-3, Van Allen Belt Predict Program, Computation Center Plot Routine, and Response Function Programs. F.O.S.

N75-10977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METEOROLOGICAL SATELLITE ACCOMPLISHMENTS
L. J. Allison, A. Arking, W. R. Bandeen, W. E. Shenk, and R. Wexler Nov. 1974 64 p refs Submitted for publication
(NASA-TM-X-70782; X-910-74-327) Avail: NTIS HC $4.25 CSCL 04B

The various types of meteorological satellites are enumerated. Vertical sounding, parameter extraction technique, and both macroscale and mesoscale meteorological phenomena are discussed. The heat budget of the earth-atmosphere system is considered, along with ocean surface and hydrology. J.A.M.

N75-10978*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF THE SERT 2 SPACECRAFT AFTER 4 AND ONE-HALF YEARS IN SPACE
Louis R. Ignaczak, N. John Stevens, and Bruce E. LeRoy Nov. 1974 24 p
(NASA-TM-X-71632; E-8162) Avail: NTIS HC $3.25 CSCL 22C

The SERT 2 satellite, launched in February, 1970, has recently been reactivated after being dormant for a year. The satellite orientation was changed to spin stabilization in 1973 and the satellite is now coning such that the active side of the solar arrays move into and out of the sun every 23 days. There is sufficient power to operate the ion thrusters for seven days of this cycle. The 2 ion thruster system was successfully operated; the electrical short in the accelerating grids had cleared during the year long dormant phase. Author

N75-10979# Naval Postgraduate School, Monterey, Calif.
PROJECTILE THRUST: DRAG OPTIMIZATION WITH EXTERNAL BURNING Ph.D. Thesis
William John Henry Smithey Jun. 1974 128 p refs
(AD-784764) Avail: NTIS CSCL 19/1

External burning increases base pressure. The characteristic and linearized equations with heat addition are discussed, and the condition for maintaining irrotationality with heat addition is derived. A transition model, which extends the Crocco-Lees base flow model, and a spin model are discussed. Computed results are compared with experiment. The optimum location for supersonic external burning is given. Author (GRA)

N75-11250* Naval Research Lab., Washington, D.C.
TIMATION 3 SATELLITE
Charles A. Bartholomew *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 7-13 (For availability see N75-11249 02-35) CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N75-10980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION OF THE GRAVSAT/GEOPAUSE MISSION
David W. Koch and Peter D. Argentiero Aug. 1974 26 p refs Presented at Am. Geophys. Union, Fall Ann. Meeting, San Francisco, 12-17 Dec. 1974
(NASA-TM-X-70776; X-932-74-288) Avail: NTIS HC $3.75 CSCL 22B

A simulation of the proposed low Gravsat and high Geopause satellite mission is presented. This mission promises fundamental improvements in the accuracy of low order geopotential coefficients by using satellite-to-satellite tracking technology coupled with a global sampling of the gravity field. Ten days of data from six stations are assumed. A drag compensation system for the low satellite is also postulated. The results show a one to two order of magnitude improvement in the accuracy of the low order coefficients through degree 8 and order 6. These results are easily adjusted to reflect a different data accuracy level and low satellite altitude. Author

N75-10981*# Corliss (William R.), Glenarm, Md.
HISTORICS OF THE SPACE TRACKING AND DATA ACQUISITION NETWORK (STADAN), THE MANNED SPACE FLIGHT NETWORK (MSFN), AND THE NASA COMMUNICATIONS NETWORK (NASCOM)
William R. Corliss Jun. 1974 360 p refs
(Contract NASw-2169)
(NASA-CR-140390) Avail: NTIS HC $10.00 CSCL 22A

The historical and technical aspects of the major networks which comprise the NASA tracking and data acquisition system are considered in a complete reference work which traces the origin and growth of STADAN, MSFN, and NASCOM up to mid-1971. The roles of these networks in both the Gemini and Apollo programs are discussed, and the separate developmental trends are identified for each network. A.A.D.

N75-10999* Kanner (Len) Associates, Redwood City, Calif.
STUDY OF THE REDUNDANCY OF TELEMETRY INFORMATION OF THE LUNA-9 AND LUNA-13 AUTOMATIC LUNAR PROBES
A. V. Kantor and T. A. Tolmadzheva *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 120-135 Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 78-88 (For availability see N75-10988 02-18)
CSCL 09F

N75-11000* Kanner (Leo) Associates, Redwood City, Calif.
DIGITAL COMPUTER MODELING OF THE PROCESS OF REDUCTION OF REDUNDANCY IN MULTICHANNEL TELEMETRY INFORMATION BY THE METHOD OF ADAPT-

IVE DISCRETIZATION WITH ASSOCIATIVE SORTING
T. A. Tolmadzheva, A. V. Kantor, and L. V. Rozhkovskiy *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 136-162 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 91-108 (For availability see N75-10988 02-18)
CSCL 09F

N75-11002* Kanner (Leo) Associates, Redwood City, Calif.
REDUCTION IN REDUNDANCY OF MULTICHANNEL TELEMETRIC INFORMATION BY THE METHOD OF ADAPTIVE DISCRETIZATION WITH ASSOCIATIVE SORTING
A. V. Kantor, V. G. Timonin, and Yu. S. Azarova *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 168-194 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 112-128 (For availability see N75-10988 02-18)
CSCL 09F

N75-11003* Kanner (Leo) Associates, Redwood City, Calif.
THE QUESTION OF THE POSSIBILITY OF USING ASSOCIATIVE COMPUTER DEVICES (ACD) FOR PARALLEL ADAPTIVE DISCRETIZATION OF MULTICHANNEL TELEMETRY INFORMATION
A. V. Kantor, S. M. Perevertkin, and T. S. Shcherbakova *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 195-216 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 129-143 (For availability see N75-10988 02-18)
CSCL 09F

N75-11007* Kanner (Leo) Associates, Redwood City, Calif.
THE ACCURACY OF AUTOMATIC TRACKING
V. V. Kastrov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 235-245 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 155-161 (For availability see N75-10988 02-18)
CSCL 22C

N75-11016* Kanner (Leo) Associates, Redwood City, Calif.
METHODS OF SYNCHRONIZATION OF TELEMETRY FRAMES USING DISTRIBUTED AND COMBINED FRAME PAUSES
Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 387-403 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 251-261 (For availability see N75-10988 02-18)
CSCL 09F

N75-11265* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION TIME DISTRIBUTION WITHIN A DEEP SPACE COMMUNICATIONS COMPLEX
Jay B. Curtright *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 203-212 refs (For availability see N75-11249 02-35)
CSCL 17B

N75-11283* ITT Federal Electric Corp., Vandenberg AFB, Calif.
PRECISE TIMING CORRELATION IN TELEMETRY RECORDING AND PROCESSING SYSTEMS
Robert B. Pickett and Frank L. Matthews *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 107-125 refs (For availability see N75-11275 02-35)
CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-10982*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF MODAL COUPLING PROCEDURES FOR THE SHUTTLE: A MATRIX METHOD FOR DAMPING SYNTHESIS Final Report
Timothy K. Hasselman Dec. 1972 120 p refs Prepared for Grumman Aerospace Corp.
(Contract NAS1-10635)
(NASA-CR-112253; TRW-18058-6001-RU-00; MEL-72-D-44) Avail: NTIS HC $5.25 CSCL 22B

The damping method was applied successfully to real structures as well as analytical models. It depends on the ability to determine an appropriate modal damping matrix for each substructure. In the past, modal damping matrices were assumed diagonal for lack of being able to determine the coupling terms which are significant in the general case of nonproportional damping. This problem was overcome by formulating the damped equations of motion as a linear perturbation of the undamped equations for light structural damping. Damped modes are defined as complex vectors derived from the complex frequency response vectors of each substructure and are obtained directly from sinusoidal vibration tests. The damped modes are used to compute first order approximations to the modal damping matrices. The perturbation approach avoids ever having to solve a complex eigenvalue problem. Author

N75-10983# Joint Publications Research Service, Arlington, Va.
HOW SPACECRAFT ARE FUELED
N. Novikov 22 Nov. 1974 23 p Transl. into ENGLISH from Nauka Zhizn (Moscow), no. 2, 1972 p 25-32
(JPRS-63514) Avail: NTIS HC $3.25

The sequence of operations and the manner of performing the basic operations in fueling rockets and spacecraft are described. Author

N75-10984*# Missouri Univ., Rolla. Dept. of Electrical Engineering.
THE USE OF PRECESSION MODULATION FOR NUTATION CONTROL IN SPIN-STABILIZED SPACECRAFT
Javin M. Taylor, Richard J. Donner (McDonnell-Douglas Corp., St. Louis), and Vehbi Tasar 30 Sep. 1974 43 p refs Backup document for AIAA synoptic scheduled for publication in the Journal of Spacecraft and Rockets in Feb. 1973
(Grant NGR-26-003-069)
(NASA-CR-139154) Avail: NTIS HC $3.75 CSCL 22B

The relations which determine the nutation effects induced in a spinning spacecraft by periodic precession thrust pulses are derived analytically. By utilizing the idea that nutation need only be observed just before each precession thrust pulse, a difficult continuous-time derivation is replaced by a simple discrete-time derivation using z-transforms. The analytic results obtained are used to develop two types of modulated precession control laws which use the precession maneuver to concurrently control nutation. Results are illustrated by digital simulation of an actual spacecraft configuration. Author

N75-10985*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT TESTS OF VIKING PARACHUTE SYSTEM IN THREE MACH NUMBER REGIMES. 2: PARACHUTE TEST RESULTS
Richard J. Bendura, Reginald R. Lundstrom, Philip G. Renfroe, and Stewart R. LeCroy Washington Nov. 1974 98 p refs (NASA-TN-D-7734; L-9537) Avail: NTIS HC $4.75 CSCL 01B

Tests of the Viking 16.15-meter nominal-diameter disk-gap-band parachute were conducted at Mach number and dynamic

pressure conditions which bracketed the range postulated for the Viking '75 mission to Mars. Parachutes were deployed at supersonic, transonic, and subsonic speeds behind a simulated Viking entry capsule. All parachutes successfully deployed, inflated, and exhibited sufficient drag and stability for mission requirements. Basic parachute data including loads, drag coefficients, pull-off angles, and canopy area ratios are presented. Trajectory reconstruction and onboard camera data methods were combined to yield continuous histories of both parachute and test-vehicle angular motions which are presented for the period from parachute deployment through steady inflation. Author

N75-10986*# Lockheed Electronics Co., Houston, Tex.
SHUTTLE ELECTRICAL POWER ANALYSIS PROGRAM (SEPAP); SINGLE STRING CIRCUIT ANALYSIS REPORT
C. R. Murdock NASA. Lyndon B. Johnson Space Center May 1974 45 p
(Contract NAS9-12200)
(NASA-CR-140301; JSC-09075; LEC-3646) Avail: NTIS HC $3.75 CSCL 22B

An evaluation is reported of the data obtained from an analysis of the distribution network characteristics of the shuttle during a spacelab mission. A description of the approach utilized in the development of the computer program and data base is provided and conclusions are drawn from the analysis of the data. Data sheets are provided for information to support the detailed discussion on each computer run. M.C.F.

N75-10987*# Chrysler Corp., New Orleans, La. Space Div.
HEAT TRANSFER TESTS OF AN 0.006-SCALE THIN-SKIN SPACE SHUTTLE MODEL (41-OTS) IN THE AMES 3.5-FOOT HWT AT M EQUALS 5.3 (IH15)
D. G. Walstad (Rockwell International Corp., Downey, Calif.) and W. K. Lockman (NASA. Ames Research Center) Oct. 1974 493 p refs
(Contract NAS9-13247)
(NASA-CR-134096; DMS-DR-2098) Avail: NTIS HC $12.00 CSCL 22B

Data obtained from heat transfer tests of an 0.006-scale space shuttle vehicle in a 3.5-foot hypersonic wind tunnel are presented. The purpose of these tests was to parametrically investigate the ascent heating of the integrated vehicle. Configurations tested were complete for integrated vehicle, orbiter alone, external tank alone, and SRB alone. All configurations were tested with and without transition grit. Testing was conducted at a Mach number of 5.3, and at Reynolds numbers of 2 and 5 million per foot. The angle of attack range varied from 0 to minus 5 degress, execpt for SRB alone, which was tested from minus 5 to 90 degrees. Heat transfer data were obtained from 223 iron-constantan thermocouples attached to thin-skin stainless steel inserts. Author

N75-10988*# Kanner (Leo) Associates, Redwood City, Calif.
EQUIPMENT FOR SPACE RESEARCH
Yu. K. Khodarev, B. N. Rodionov, V. V. Andreyanov, N. N. Krupenio, L. I. Shatrovskiy, Yu. M. Shtarkov, P. Ye. Elyasberg, and V. S. Etkin Washington NASA Oct. 1974 417 p refs Transl. into ENGLISH of the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 1-263
(Contract NASw-2481)
(NASA-TT-F-785) Avail: NTIS HC $10.50 CSCL 22B

Studies of interplanetary probe and landing equipment are given, covering radio and TV systems, orientation and computer systems, data synchronization and compression techniques, and automatic follow-up and photogrammetric equipment. The state of this technology is discussed and future developments are visualized. For individual titles, see N75-10989 through N75-11016.

N75-10989* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF THE LANDING POINT AND ORIENTATION OF A SPACECRAFT ON MARS c91
G. A. Mersov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 1-22 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 3-15 (For availability see N75-10988 02-18)
CSCL 22A

Formulas are presented to calculate the landing point of a spacecraft on Mars. The areographic latitude is taken as the angle between a plumb line at the landing point and the plane perpendicular to the axis of rotation of Mars relative to the sun. The ephemeral time of the upper culmination of the sun at the landing point is used to determine areographic longitude. A coupled system and a topocentric system of coordinates are introduced to develop the first series of equations. Both errors which are independent random quantities and systematic errors are considered, as well as the influence of the distance of the landing point from the boundary of the area of polar night. Author

N75-10990* Kanner (Leo) Associates, Redwood City, Calif.
LOW NOISE PARAMETRIC AMPLIFIERS FOR RADIO ASTRONOMY OBSERVATIONS AT 18-21 cm WAVELENGTH c89
B. Z. Kanevskiy, V. M. Veselov, I. A. Strukov, and V. S. Etkin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 23-27 Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 16-18 (For availability see N75-10988 02-18)
CSCL 03A

The principle characteristics and use of SHF parametric amplifiers for radiometer input devices are explored. Balanced parametric amplifiers (BPA) are considered as the SHF signal amplifiers allowing production of the amplifier circuit without a special filter to achieve decoupling. Formulas to calculate the basic parameters of a BPA are given. A modulator based on coaxial lines is discussed as the input element of the SHF. Results of laboratory tests of the receiver section and long-term stability studies of the SHF sector are presented. Author

N75-10991* Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF THE DESIGN OF LOW-NOISE INPUT DEVICES c32
V. M. Manokhin, Yu. A. Nemlikher, I. A. Strukov, and Ye. A. Sharfov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 28-35 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 19-23 (For availability see N75-10988 02-18)
CSCL 17B

An analysis is given of the requirements placed on the elements of parametric centimeter waveband amplifiers for achievement of minimal noise temperatures. A low-noise semiconductor parametric amplifier using germanium parametric diodes for a receiver operating in the 4 GHz band was developed and tested confirming the possibility of satisfying all requirements. Author

N75-10992* Kanner (Leo) Associates, Redwood City, Calif.
PHOTOGRAMMETRIC METHOD OF DETERMINATION OF DEFLECTION OF LIGHT BEAMS BY PORTHOLE GLASS UNDER SPACE FLIGHT CONDITIONS c74
Ya. L. Ziman *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 36-41 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 24-27 (For availability see N75-10988 02-18)
CSCL 20F

It is suggested that a measuring camera be used to determine the deflection of light rays through the glass portholes of hermetically sealed spacecraft. It is desirable that the camera have the greatest possible lens aperture diameter to increase the number and stellar magnitude of stars photographed. The article describes comparison of photographs within and outside the spacecraft and recommends similar tests in flight using oriented spacecraft. Author

N75-10993* Kanner (Leo) Associates, Redwood City, Calif.
DEVELOPMENT OF THE DESIGN OF A BETWEEN-THE-LENS BAND TYPE PHOTOGRAPHIC SHUTTER c35
A. S. Dorofeyev *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 42-47 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 28-30 (For availability see N75-10988 02-18)
CSCL 14E

When photographic equipment is miniaturized, in order to conserve weight and size for spacecraft use, by using wide angle,

short focus lenses, a band-type central between-the-lens shutter must be used. The rectangular slot shape was the form with the highest optical efficiency. To overcome the problem of burrs caused in the punching out of the slots in a carbon steel band, a shape limited by arcs with radius equal to half the slot width is preferred. Author

N75-10994* Kanner (Leo) Associates, Redwood City, Calif.
METHODS OF RADAR STUDIES OF THE MOON AND THE PLANETS FROM SPACECRAFT **c32**
N. N. Krupenio *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p-48-64 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 31-42 (For availability see N75-10988 02-18)
CSCL 17I

Radar studies of the moon and planets from the earth have been valuable but limited in comparison to radar studies from spacecraft. Autonomous and non-autonomous methods of radar research from space satellites and probes are considered. Results of both the Luna and Surveyor series of lunar spacecraft are presented. It is concluded that use of radar in spacecraft allows valuable, high resolution measurement even near the limb and on the back side of the moon. Author

N75-10995* Kanner (Leo) Associates, Redwood City, Calif.
MULTIPLE-SLIT SHADOW DEVICE FOR SENSING THE DIRECTION TO A SHINING OBJECT **c35**
A. V. Bruns *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 65-87 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 43-58 (For availability see N75-10988 02-18)
CSCL 14B

A multi-slit shadow direction sensor of jalousie type (JDS) was developed to provide a simple, highly reliable tracking system to guide a rotating mirror toward the sun so that the reflected light would illuminate the input slit of a photoelectric spectrometer. The operating principle and stability are considered as well as determination of initial signal level at the output of each photosensor. A procedure is recommended for calculation of a JDS. Both one- and two-coordinate sun direction sensors are described and considered for use in the tracking system of a photoelectric spectrometer. Author

N75-10996* Kanner (Leo) Associates, Redwood City, Calif.
COMPUTERS AND PROSPECTS FOR ON-BOARD SPACECRAFT ELECTRONIC EQUIPMENT **c62**
V. V. Andreyanov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 88-96 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 58-63 (For availability see N75-10988 02-18)
CSCL 09B

Conversion of spaceborne telemetry and transceiving data with digital computers is discussed. The ways computers may allow selection of the most informative of the total number of measurements are discussed along with development of compatible transceiver equipment. Author

N75-10997* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECTIVENESS OF CORRECTING CODES IN RECEPTION IN THE WHOLE IN ADDITIVE NORMAL WHITE NOISE **c32**
Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 97-106 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 64-69 (For availability see N75-10988 02-18)
CSCL 17B

Some possible criteria for estimating the effectiveness of correcting codes are presented, and the energy effectiveness of correcting codes is studied for symbol-by-symbol reception. Expressions for the energetic effectiveness of binary correcting codes for reception in the whole are produced. Asymptotic energetic effectiveness and finite signal/noise ratio cases are considered. Author

N75-10998* Kanner (Leo) Associates, Redwood City, Calif.
SELECTION OF AN OPTIMAL PLAN FOR CONSTRUCTION OF A SPACECRAFT ANTENNA SYSTEM **c32**
B. A. Prigoda, M. B. Faynshteyn, V. A. Guryev, and A. S. Markin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 107-119 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 169-177 (For availability see N75-10988 02-18)
CSCL 09E

An attempt is made to summarize the experience of the design of antennas for various types of spacecraft: fully oriented, partially oriented, and with arbitrary orientation. Several examples of the construction of antenna systems and their characteristics are given. The optimal relationship between weight, dimension and power characteristics of on-board devices allows selection of the most acceptable versions. Questions are presented for consideration in design of optimal spacecraft antenna-feeder systems. Author

N75-10999* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF THE REDUNDANCY OF TELEMETRY INFORMATION OF THE LUNA-9 AND LUNA-13 AUTOMATIC LUNAR PROBES **c17**
A. V. Kantor and T. A. Tolmadzheva *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 120-135 Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 78-88 (For availability see N75-10988 02-18)
CSCL 09F

Knowledge of the statistical characteristics of natural telemetry information is important for the development of principles and methods of reduction of redundancy of telemetry messages as well as planning of on-board information compression devices. An evaluation was made to determine these characteristics for the telemetry information of the Luna-9 and Luna-13 automatic lunar probe, to allow estimation of the redundancy of the information. Histograms as well as numerical characteristics were used. Author

N75-11000* Kanner (Leo) Associates, Redwood City, Calif.
DIGITAL COMPUTER MODELING OF THE PROCESS OF REDUCTION OF REDUNDANCY IN MULTICHANNEL TELEMETRY INFORMATION BY THE METHOD OF ADAPTIVE DISCRETIZATION WITH ASSOCIATIVE SORTING **c17**
T. A. Tolmadzheva, A. V. Kantor, and L. V. Rozhkovskiy *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 136-162 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 91-108 (For availability see N75-10988 02-18)
CSCL 09F

Digital computer modeling of the process of adaptive discretization with associative sorting of actual multichannel telemetry information is discussed. The main task in modeling is production of initial data for determination of dependences describing the operation of the on-board information compression device. Conclusions are presented including the shortcomings of telemetric information used in modeling. Author

N75-11001* Kanner (Leo) Associates, Redwood City, Calif.
CIRCULARLY POLARIZED ANTENNAS WITH CONTROLLED RADIATION PATTERNS **c32**
B. A. Prigoda, V. A. Guryev, N. S. Ulyanin, and N. N. Kalugin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 163-167 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 109-112 (For availability see N75-10988 02-18)
CSCL 09E

Log-helix conical antennas were examined as a way to satisfy the requirement for circular polarization of antennas for spacecraft use. It was concluded that a multiple-helix antenna which allows the helix lead angle to be changed can be used when the radiation and directivity in the direction of the reception point must be changed during flight. Author

N75-11002* Kanner (Leo) Associates, Redwood City, Calif.
REDUCTION IN REDUNDANCY OF MULTICHANNEL TELEMETRIC INFORMATION BY THE METHOD OF ADAPTIVE DISCRETIZATION WITH ASSOCIATIVE SORTING **c17**

A. V. Kantor, V. G. Timonin, and Yu. S. Azarova *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 168-194 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 112-128 (For availability see N75-10988 02-18)
CSCL 09F

The method of adaptive discretization is the most promising for elimination of redundancy from telemetry messages characterized by signal shape. Adaptive discretization with associative sorting was considered as a way to avoid the shortcomings of adaptive discretization with buffer smoothing and adaptive discretization with logical switching in on-board information compression devices (OICD) in spacecraft. Mathematical investigations of OICD are presented. Author

N75-11003* Kanner (Leo) Associates, Redwood City, Calif.
THE QUESTION OF THE POSSIBILITY OF USING ASSOCIATIVE COMPUTER DEVICES (ACD) FOR PARALLEL ADAPTIVE DISCRETIZATION OF MULTICHANNEL TELEMETRY INFORMATION **c17**
A. V. Kantor, S. M. Perevertkin, and T. S. Shcherbakova *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 195-216 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 129-143 (For availability see N75-10988 02-18)
CSCL 09F

The method of parallel adaptive discretization of data is considered the most promising and allows the effective compression algorithms to be used for high information-capacity radio telemetry systems. An associative computer device (ACD), i.e., parallel computers based on associative memory units (AMU), are recommended for realization of this method. A detailed discussion of the problems of application of AMU is followed by description of a particular ACD and its recommended use. Author

N75-11004* Kanner (Leo) Associates, Redwood City, Calif.
HIGH FREQUENCY SWITCHING DEVICES **c33**
B. A. Prigoda, Ye. A. Vlasov, A. S. Markin, and E. I. Yakovlev *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 217-221 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 143-146 (For availability see N75-10988 02-18)
CSCL 09A

Switching devices using various circuits of electronic or mechanical elements depending on the operating conditions and purpose of the switching were investigated and their uses are discussed. Author

N75-11005* Kanner (Leo) Associates, Redwood City, Calif.
SHF FILTERS IN SPACECRAFT ANTENNA-FEEDER SYSTEMS **c33**
Ye. A. Vlasov and B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 222-227 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 147-149 (For availability see N75-10988 02-18)
CSCL 09A

The use of SHF-band filters in spacecraft antenna-feeder systems was investigated. These filters, depending on specific applications and requirements, may be constructed both of elements with lumped constants and of elements with distributed parameters. Author

N75-11006* Kanner (Leo) Associates, Redwood City, Calif.
CHECKING THE PARAMETERS OF AFS IN SPACECRAFT IN FLIGHT **c33**
Ye. A. Vlasov, B. A. Prigoda, and A. S. Markin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 228-234 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 150-154 (For availability see N75-10988 02-18)
CSCL 09E

The use of elements for remote testing of matching of on-board spacecraft antennas, required by the need to receive timely telemetry information on the quality of operation of antenna-feeder systems (AFS) during long flights, is discussed. Information on the traveling wave ratio deficiency to the AFS allowed improvement of quality and reliability of communications with spacecraft and developed telemetric information on the matching of on-board antennas, the efficiency of the feeder system and power of transmitters during long flights. Author

N75-11007* Kanner (Leo) Associates, Redwood City, Calif.
THE ACCURACY OF AUTOMATIC TRACKING **c17**
V. V. Kastrov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 235-245 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 155-161 (For availability see N75-10988 02-18)
CSCL 22C

It has been generally assumed that tracking accuracy changes similarly to the rate of change of the curve of the measurement conversion. The problem that internal noise increases along with the signals processed by the tracking device and that tracking accuracy thus drops were vonsidered. The main prerequisite for solution is consideration of the dependences of the output signal of the tracking device sensor not only on the measured parameter but on the signal itself. Author

N75-11008* Kanner (Leo) Associates, Redwood City, Calif.
COMMUNICATIONS BY LIGHT WITH LONG-RANGE SPACECRAFT **c32**
M. Z. Novikov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 246-263 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 161-172 (For availability see N75-10988 02-18)
CSCL 17B

Light contact with long-range spacecraft flying between the earth and the moon was considered. The possibility of creating on-board light signaling devices and the problems of construction of light signal receiving devices are studied. It was concluded that signaling using constant burning lamps is most favorable for observation of the spacecraft and transmission of information from the spacecraft. Author

N75-11009* Kanner (Leo) Associates, Redwood City, Calif.
DATA COMPRESSION **c60**
V. F. Babkin, A. B. Kryukov, and Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 264-318 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 173-209 (For availability see N75-10988 02-18)
CSCL 09B

An approach to data compression is discussed in which the effect achieved by compression is evaluated by the closeness of the approach to the minimum possible volume. An attempt is made to systematize the known results on data compression. The review contains: description of methods of data compression based on statistical coding and information theory; application of methods of interpolation and extrapolation; a specific compression method (related to description of the histogram of a sample); some criteria of effectiveness and methods of service information representation; and discussion of models suggested for theoretical analysis. Author

N75-11010* Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF THE EFFECTIVENESS OF A GAMMA TELESCOPE **c89**
Yu. A. Rylov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 319-334 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 210-218 (For availability see N75-10988 02-18)
CSCL 17H

A calculation is given of the effectiveness of recording of gamma quanta by a gamma telescope. Consideration of the isotropic nature of the stream of gamma quanta reaching the gamma telescope revealed that low energy gamma quanta are recorded relatively more effectively, since they are recorded from a wider solid angle than higher energy gamma quanta. The problem is solved of determining the effectiveness of recording of gamma quanta and determination of their energies by a gamma telescope. Author

N75-11011* Kanner (Leo) Associates, Redwood City, Calif.
THE PROBLEM OF CONTROLLING THE DIRECTIVITY OF LOW DIRECTIVITY ANTENNAS ON SPACECRAFT IN FLIGHT **c33**
V. I. Mashkov and B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 335-338 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 219-220 (For availability see N75-10988 02-18)
CSCL 09E

Interests exist in the creation of antennas allowing adjustment of the radiation pattern and directivity in flight without using complex switching and matching circuits. Results are presented of certain experimental tests performed with log-periodic conical helical antennas to determine the possibilities of regulation of their radiation patterns without changing the structure of the current-carrying elements, supply connections, etc. Author

N75-11012* Kanner (Leo) Associates, Redwood City, Calif.
SOME PROBLEMS OF THE DESIGN OF HIGHLY DIRECTIONAL SPACECRAFT ANTENNAS **c33**
B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 339-352 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 221-229 (For availability see N75-10988 02-18)
CSCL 09E

Problems of optimization and selection of the most expedient forms of design of directional antenna systems encountered in spacecraft design are discussed. Selection of a given type of antenna depends on its characteristic size, weight, and potential. Author

N75-11013* Kanner (Leo) Associates, Redwood City, Calif.
POTENTIAL CAPABILITIES FOR COMPRESSION OF INFORMATION OF CERTAIN DATA PROCESSING SYSTEMS **c60**
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 353-367 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 353-367 (For availability see N75-10988 02-18)
CSCL 09B

This article undertakes to study a generalized block diagram of a data collection and processing system of a spacecraft in which a number of sensors or outputs of scientific instruments are cyclically interrogated by a commutator, methods of writing the supplementary information in a frame on the example of a certain hypothetical telemetry system, and the influence of statistics of number of active channels in a frame on frame compression factor. The separation of the data compression factor of the collection and processing system of spacecraft into two parts used in this work allows determination of the compression factor of an active frame depending not only on the statistics of activity of channels in the telemetry frame, but also on the method of introduction of the additional address and time information to each frame. Author

N75-11014* Kanner (Leo) Associates, Redwood City, Calif.
STATISTICAL ANALYSIS OF INFORMATION FROM LONG-RANGE SPACECRAFT **c60**
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 368-378 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 239-245 (For availability see N75-10988 02-18)
CSCL 09B

Results are presented of analysis of statistical characteristics of information from spacecraft data compression systems, ignoring the nature of channel activity. Analysis of the distribution of the number of active channels and the channel activities was performed using data from scientific experiments conducted on the Zond-1 and Venera-4 spacecraft. Author

N75-11015* Kanner (Leo) Associates, Redwood City, Calif.
A PRIORI ESTIMATE OF THE QUALITY OF A DATA COMPRESSION SYSTEM BASED ON STATISTICAL CHARACTERISTICS OF THE SENSORS USED **c60**
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 379-386 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 246-250 (For availability see N75-10988 02-18)
CSCL 09B

Knowledge of the composition and certain statistical characteristics of the output signals of the scientific instruments on board a space vehicle allows determination of possible signal processing algorithms in the system and to evaluate the prospects for utilization of data reduction. A method is presented to estimate the compression factor of an on-board data collection and processing system with known mean activities of the sensors used and unknown mutual correlation of their output signals. Author

N75-11016* Kanner (Leo) Associates, Redwood City, Calif.
METHODS OF SYNCHRONIZATION OF TELEMETRY FRAMES USING DISTRIBUTED AND COMBINED FRAME PAUSES **c17**
Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 387-403 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 251-261 (For availability see N75-10988 02-18)
CSCL 09F

Two modifications of the method of frame synchronization by means of a frame pause were studied. The first does not require that all characters in the frame pause follow each other immediately. The second modification is based on the use of one particular type of redundancy within the frame to achieve frame synchronization without setting aside a special frame pause. Concentrated, distributed and combined frame pause are described and their uses compared. Author

N75-11017# Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.
INVESTIGATION OF INTERMEDIATE AND MAXIMUM RANGE MISSILES PRODUCED BY CRATERING EXPERIMENTS
J. F. Dishon, III Mar. 1974 105 p refs
(EERL-MP-E-74-2) Avail: NTIS HC $5.25

A method is developed for the prediction of the probability of missile impact upon a given structure or object and the maximum missile range from a cratering event. The data are from missile areal distribution studies made after several high explosive cratering events. Several empirical and theoretical scaling techniques are used to combine the missile areal distribution data into a form that allows the prediction of missile impact probability and maximum missile range as a function of charge yield, media, and depth of burial. This method of prediction is of direct interest in determining missile damage from typical explosive cratering events. Author (NSA)

N75-11018# Sandia Labs., Albuquerque, N.Mex.
EFFECTS OF UNSYMMETRICAL STABILITY DERIVATIVE CHARACTERISTICS AND TRANSVERSE PRODUCTS OF INERTIA ON REENTRY VEHICLE TRIM ANGLE BEHAVIOR
A. E. Hodapp, Jr. Apr. 1974 42 p refs
(Contract AT(29-1)-789)
(SLA-74-77) Avail: NTIS HC $3.75

Analytical results and results of digital simulations are presented for an investigation of the effects of unsymmetrical stability derivative coefficients for reentry vehicles. The transverse product of inertia on the trim angle behavior of slender rolling bodies is also developed. It is shown that near resonance, when these asymmetries are present, the trim angle behavior can become more unstable than the trim angle behavior displayed by reentry vehicles with symmetrical aerodynamic stability derivative coefficients, zero product of inertia, and equivalent trim producing symmetries. Author

N75-11019# Engins Matra, Velizy (France).
STUDY OF ATTITUDE CONTROL AND STABILISATION SYSTEM EMPLOYING MULTIPLE FIXED WHEELS Final Report
Marivin, Havas, Laprie, and Reynier [1973] 572 p refs Prepared jointly with CNRS, Toulouse

(Contract ESTEC-422-A0)
(ESRO-CR(P)-529) Avail: NTIS HC $13.00

A study on multiwheel systems for satellite attitude control and stabilization was carried out. Three types of attitude control systems are discussed: two with a resulting biased kinetic momentum along the pitch axis, and one where only reaction wheels are used. Several linear control laws are proposed, and off-loading was examined. The behavior of a satellite stabilized by constant inertia flywheels was investigated by means of performance calculation and simulations. Simulation methods and programs are detailed. Mechanization and integration of the multiwheel systems in a stabilization system are discussed in detail. ESRO

N75-11020# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PROBABILITY OF CRASHING FOR A TERRAIN-FOLLOWING MISSILE
Edward P. Cunningham Apr. 1974 26 p refs
(Contract N00017-72-C-4401)
(AD-784376; APL-TG-1239) Avail: NTIS CSCL 16/4

The report deals with the derivation of a new expression for PC, the probability of crashing, for a terrain-following missile. It is compared with the older, commonly used expression for PC. In general, it gives more pessimistic results; i.e., the missile must fly higher in order to achieve a probability of not crashing equal to that obtained by the older method. Author (GRA)

N75-11021*# Chrysler Corp., New Orleans, La. Space Div.
WIND TUNNEL TEST RESULTS FOR THE DIRECTION CONTROLLED ANTITANK DCAT MISSILE AT MACH NUMBERS FROM 0.64 TO 2.50
T. A. Martin and Donald J. Spring 12 Oct. 1973 272 p
(NAS9-13247; DA Proj. 1M2-62303-A-214)
(NASA-CR-140750; AD-784121; RD-73-27) Avail: NTIS HC $8.50 CSCL 19/1

Wind tunnel test results are presented to show aerodynamic characteristics over the Mach number range of 0.64 to 2.50 of the DCAT missile. Data are presented showing the interference created by the rear mounted reaction control system. Two candidate fins were installed on the model during tests: a flat folding fin and a curved wrap around fin. Author (GRA)

N75-11022# Office of the Director of Defense Research and Engineering, Washington, D.C.
T AND E GUIDELINES FOR MISSILE WEAPON SYSTEMS
2 Apr. 1974 45 p
(AD-784396) Avail: NTIS CSCL 15/5

The checklist items presented are specifically applicable to missile testing and evaluation and are organized into time phases of the acquisition process. The checklists cover various aspects of the major activities that should be underway during a given time period. Hence, a checklist might cover the (1) evaluation of work that occurred in the previous phase, (2) conduct of tests planned in the previous phase and executed in the subject phase, and (3) plans and other preparatory actions for test schedules to be conducted in a subsequent phase. GRA

N75-11023# Aerospace Corp., El Segundo, Calif.
ABLATION INSTRUMENTATION EFFECTS ON CARBON-CARBON NOSETIP PERFORMANCE Interim Report
Phillip J. Legendre, Donald C. Howey, Albert W. Mitton, and Robert L. Collins 7 Aug. 1974 20 p refs Prepared in cooperation with Avco Corp., Wilmington, Mass.
(Contracts F04701-73-C-0074; F04701-74-C-0075)
(AD-784825; TR-0075(5450-72)-1; SAMSO-TR-74-184) Avail: NTIS CSCL 16/3

During the past five years, a specific class of carbonaceous materials consisting of carbon matrices reinforced with high strength carbon fibers has been developed for application on high-performance missiles as nosetip, heatshield, leading edge, and rocket nozzle materials. This paper deals with the effects of instrumentation installation design parameters upon the ablative performance of the nosetips as observed in recent ground tests. Included in these parameters were: the nature of the radioactive source (i.e., wire or pellet), the diameter of the hole drilled into the nosetip into which the pellet and/or wire source assembly is inserted, the method of bonding the source assembly into the nosetip, the configuration of multiple source assemblies mounted into the nosetip, and the orientation of installing these source assemblies (radially or axially) into the nosetip. The results of these tests, as discussed in this paper, showed that certain installation design parameters had a major impact upon the ablation performance of the carbon-carbon nosetips. (Modified author abstract) GRA

N75-11024# Naval Postgraduate School, Monterey, Calif.
PRELIMINARY RESULTS CONCERNING THE IMPROVEMENTS REALIZABLE THROUGH THE USE OF VARIABLE THRUST TOGETHER WITH ENGINE GIMBALING FOR A PARTICULAR INTERCEPTOR MISSILE
I. Bert Russak Jun. 1974 28 p refs
(ZF61512)
(AD-784365; NPS-3RU74061) Avail: NTIS CSCL 15/3

Some interceptor missiles as presently formulated possess a programmed thrust magnitude history with a gimbaled engine to provide steering. One such missile was examined to determine whether performance can be improved if we allow a variable thrust magnitude together with engine gimbaling to provide control. Two trajectory optimization programs were written to provide an initial answer to this problem. Preliminary results indicate reductions in the time to intercept by as much as thirty per-cent over that obtained by the presently used guidance scheme. With tuning of the programs it seems reasonable to expect even greater improvements. Author (GRA)

N75-11236 Joint Publications Research Service, Arlington, Va.
PERIODIC MOVEMENTS OF A TRIAXIAL GYROSCOPIC SPACECRAFT STABILIZATION SYSTEM
V. V. Polyakov *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 34-42 refs Transl. into ENGLISH from Izv. Akad Nauk SSR, Mekh. Tverdogo Tela (USSR), no. 2, 1974 p 9-15 (For availability see N75-11231 02-35)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-11025*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA BOOK FOR 12.5-INCH DIAMETER SRB THERMAL MODEL WATER FLOTATION TEST - 14.7 PSIA, SERIES P024
Steve L. Allums May 1974 308 p
(NASA-TM-X-70387; M-EP-74-8) Avail: NTIS HC $9.25 CSCL 21H

Tests were conducted to determine how thermal conditions affect space shuttle solid rocket booster (SRB) flotation. Acceleration, pressure, and temperature data were recorded from initial water impact to final flotation position using a 12.5-inch diameter thermal model of the SRB at ambient pressure. The model was 136.9 inches long and weighed 117.3 lbm. The tests indicated the following differences from ambient temperature tests: (1) significant negative static pressures can occur

during penetration; (2) maximum penetration is increased; and (3) final flotation is in the spar buoy mode. Author

N75-11026# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
POGO SUPPRESSION ON THE DELTA VEHICLE Interim Report, Jan. 1972 - Nov. 1973
J. G. Payne and S. Rubin 7 Jun. 1974 62 p refs
(Contract F04701-73-C-0074)
(AD-784833; TR-0074(4704)-1; SAMSO-TR-74-187) Avail: NTIS CSCL 21/8

A long succession of Delta vehicles (including their Thor/Delta and Thor/Agena predecessors) have experienced pogo instability in the twenty seconds prior to cutoff of the first stage. The study reported here led to the suppression of this instability on the ITOS-F vehicle launched in November 1973. Suppression was achieved by the addition of flow resistance to an existing accumulator installed in the lox suction line. The ability to achieve the suppression resulted from a joint study by The Aerospace Corporation and McDonnell Douglas Astronautics Corporation. The study was designed to develop a pogo stability model yielding eigenvalues and eigenvectors consistent with flight data over a range of vehicle configurations, engine operating conditions, and presence or absence of a lox accumulator. Extensive reduction of flight data in the form of spectral analyses was required. Based on this model, it was possible to optimize the accumulator resistance for vehicle stability. Author (GRA)

N75-11027# Physical Dynamics, Inc., Berkeley, Calif.
BASELINE CHEMISTRY MODEL FOR PLUME RADIATION PREDICTIONS Interim Report
Edward R. Fisher and Ralph H. Kummler Dec. 1973 63 p refs
(Contract F19628-72-C-0006; ARPA Order 1856; AF Proj. 8692)
(AD-784858; SR-5; PD-73-052; AFCRL-TR-74-0175) Avail: NTIS CSCL 21/2

Four baseline chemistry models which include a detailed reaction mechanism, temperature dependent rate coefficients and radiative properties are presented. The four models include: APOLLO Model for the O/H/OH/H2/O2/H2O system; RELAXATION Model for the O/H/N2/CO/H2O/CO2 system; HYDROCARBON Model for hydrocarbon fuel afterburning; and AMINE Model for amine/substituted amine afterburning. Preliminary calculations are presented on the RELAXATION and AMINE Models while references are listed for a more thorough discussion. Author (GRA)

N75-11028# Aerojet Solid Propulsion Co., Sacramento, Calif.
INVESTIGATION OF SUPPRESSION DEVICES TO STABILIZE COMBUSTION IN SOLID ROCKET MOTORS Final Report, May 1972 - May 1974
S. E. Colucci Aug. 1974 186 p refs
(Contract F04611-72-C-0080)
(AD-784872; AFRPL-TR-74-39) Avail: NTIS CSCL 21/8

A program was conducted to investigate suppression devices for stabilization of combustion in solid rocket motors. The program encompassed tests with both aluminized and smokeless propellants to screen various devices and scaling of the most promising device for large motor tests (6 to 10 in. dia). In laboratory screening and small scale motor tests the devices evaluated included: single orifice, multi-orifice, and configured (finocyl) baffles designed to be placed within the motor before propellant casting; cantilevered baffles supported from one end designed for retrofit into existing motors; and, various resonators (acoustic absorbers) also designed for easy retrofit to existing motors. (Modified author abstract) GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N75-11029*# Kanner (Leo) Associates, Redwood City, Calif.
ERGOT ALKALOIDS
A. Stoll Washington NASA Dec. 1974 29 p refs Transl. into ENGLISH from Kagaku no Ryoiki (Japan), v. 14, no. 11, 1960 p 755-767
(Contract NASw-2481)
(NASA-TT-F-16018) Avail: NTIS HC $3.75 CSCL 07C

Natural ergot alkaloids and their chemical synthesis are discussed. The absolute structure of lysergic acid, isolysergic acid and their natural levorotatory and dextrorotatory alkaloids are established, with emphasis on isomerization. Ergobasine or ergometrine, and racemic isolysergic acid hydrazide are related to lysergic acid, and the side effects of D-lysergic acid diethylamine are discussed, along with methods for its preparation. These amino acid-type alkaloids are compared with the peptide-type alkaloids, such as ergotamine and ergotoxine, and their decomposition products are compared. The structure of ergotamine is presented as typical of peptide type alkaloids. New clavine type alkaloids are similarly discussed. The effects of these alkaloids in medical use is discussed, and the pharmacodynamic properties of ergot alkaloids are classified. Author

N75-11030# Sandia Labs., Albuquerque, N.Mex.
ENERGY-ABSORBING CHARACTERISTICS OF MATERIALS
T. K. Hill and W. W. Joseph May 1974 18 p
(Contract AT(29-1)-789)
(SLA-74-159) HC $3.25

Tests were performed to supplement scarce data on the static-force vs deflection characteristics of materials subjected to 70-80 percent strain. The tests served as a quick and economical technique for the gross screening of materials for their energy-absorbing capabilities. The results of static tests were checked in a series of dynamic tests. The tests and the results obtained are described. Author

N75-11031# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
PROGRESS IN STANDARDIZATION OF ANALYTICAL METHODS FOR MATERIALS OF NUCLEAR INTEREST. 2: STANDARD METHOD FOR COMBUSTION: THERMAL CONDUCTIVITY DETERMINATION OF TOTAL CARBON IN STEELS AND ALLOYS
A. M. Castagnola and C. Meloni Feb. 1974 30 p refs
(RT/CHI-(74) 1) Avail: AEC Depository Libraries HC $4.50

The combustion-thermal conductivity method for determination of carbon was revised and standardized for analytical control purposes. The method can be applied to the analysis of total carbon contained in stainless steels, electrolytic iron and titanium-, nickel-, cobalt-, copper- and zirconium-based alloys in the concentration range of 0.007 to 1.2%. A modified method of calculation based on statistical considerations is suggested. The detection limit is 3 micrograms of carbon. The limits for the mean in the range 80 to 100 micrograms of carbon at a probability of 0.05% (5% risk) and with 4-10 degrees of freedom are + or - 3 to 6%. Author (NSA)

N75-11032# Nordisk Institut for Teoretisk Atomfysik, Copenhagen (Denmark). Niels Bohr Inst.
EQUATION OF STATE AT ULTRA HIGH DENSITIES
V. Canuto 1974 152 p refs
(NP-20012) Avail: AEC Depository Libraries HC $10.75

The current status of knowledge about matter at unusually high densities is reviewed. Densities in the range 10 to the 6th power to 10 to the 15th power g/cucm are considered. NSA

N75-11033# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
TRANSPORT PROPERTIES OF SELECTED ELEMENTS AND COMPOUNDS IN THE GASEOUS STATE, PART 2 Final Report
Peter E. Liley Dec. 1973 87 p refs
(Grant AF-AFOSR-2396-72; AF Proj. 9750)
(AD-782024; TPRC-22; AFOSR-74-1165TR) Avail: NTIS CSCL 07/4

Tables of viscosity, thermal conductivity, and diffusion coefficient have been prepared for sixty-nine binary mixtures. The temperature range was from 100 to 3000 K. For the substances comprising the binary mixtures recent recommendations were used, some of these being taken from our earlier

report (Part 1). For the mixtures the Lennard-Jones 6-12 potential was used for viscosity and diffusion, and a linear mixing rule was employed for thermal conductivity. The precision of the tabulated values is reviewed. It is concluded that significant discrepancies can still exist between theoretical and experimental quantities. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N75-11034# Advisory Group for Aerospace Research and Development, Paris (France).
SPECIALISTS MEETING ON DIRECTIONALLY SOLIDIFIED IN-SITU COMPOSITES
E. R. Thompson, ed. and P. R. Sahm, ed. Aug. 1974 163 p refs Presented at the 38th Meeting of the Struct. and Mater. Panel, Washington, D. C., 23-24 Apr. 1974
(AGARD-CP-156) Avail: NTIS HC $6.25

Directionally solidified in-situ eutectic alloy composites and their use in fabricating aircraft parts were studied. Data cover microstructure, mechanical properties, and high temperature stability. Turbine blade design and fabrication and improvements observed in engines constructed from the composites are discussed. For individual titles, see N75-11035 through N75-11047.

N75-11035 General Electric Co., Cincinnati, Ohio.
REQUIREMENTS FOR AND CHARACTERISTICS DEMANDED OF HIGH TEMPERATURE GAS TURBINE COMPONENTS **c07**
L. P. Jahnke and C. A. Bruch *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 3-12 refs (For availability see N75-11034 02-24)

Composite structures consisting of high strength fibers or plates in ductile matrices with outstanding high temperature properties are achievable in directionally solidified eutectics. This new class of materials represents a major innovation in gas turbine blade technology. The advantages and limitations of the two more promising eutectic systems and the relationship of these properties to turbine blade design is discussed. Innovations in design and further property improvements will be required to successfully exploit these materials in engine hardware. It is concluded that the payoff offered by this technology fully justifies a major investment of resources to achieve a practical system. Author

N75-11036 Toronto Univ. (Ontario). Dept. of Metallurgy and Materials Science.
THE STRUCTURE AND THERMAL STABILITY OF EUTECTIC ALLOYS **c26**
G. C. Weatherly *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 13-20 refs (For availability see N75-11034 02-24)

The factors that control the as-grown morphology, crystallography and thermal stability of uni-directionally solidified eutectic alloys are briefly reviewed. The crystallographic orientation relationships that are usually found in UDG alloys are considered only in their bearing on the thermal stability problem. The stability of rod morphologies and the possible coarsening mechanisms in faulted and perfect arrays of parallel rods are discussed for the extreme cases of diffusion and interface-controlled reactions. The coarsening mechanisms in lamellar eutectics are simpler and are controlled by the faults grown-in during solidification. The roles of lamellar terminations, sub-grains and discontinuous coarsening at migrating grain boundaries are considered. Finally, the problems encountered in phase stability of carbide reinforced nickel based superalloys during that hot tensile deformation, are reviewed. Author

N75-11037 Drexel Univ., Philadelphia, Pa. Dept. of Metallurgy Engineering.
THE MECHANICAL METALLURGY OF DIRECTIONALLY SOLIDIFIED COMPOSITES: STRENGTHENING FUNDAMENTALS, TENSILE, CREEP, FATIGUE AND TOUGHNESS PROPERTIES
Alan Lawley *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 21-33 refs Sponsored by the Navy (For availability see N75-11034 02-24)

A fundamental basis for the interpretation and prediction of the mechanical behavior of in-situ composites is developed by considering possible strengthening mechanisms and associated models. Experimental property data and structural observations are then discussed in light of these mechanisms. The general features of tensile, creep, fatigue, and impact loading are characterized and behavior interpreted from the viewpoint of structure. Where possible, observed and predicted response of in-situ composites are compared, as is the behavior of comparable synthetic composites. The various structure-mechanical property correlations allow for a rationalization of the major advantages and disadvantages of in-situ composites vis a vis synthetic composites and other advanced structural materials. Author

N75-11038 Domaine Univ., Saint Martin d.Heres (France). Lab. de Thermodynamique et Physico-Chimie Metallurgiques.
ORIENTATION SOLIDIFICATION OF BIPHASE COMPOSITES: CASE OF MULTICONSTITUENT SYSTEMS, LAMINAR AND POINT DEFECT PHASES [SOLIDIFICATION ORIENTEE DE COMPOSITES BIPHASE: CAS DES SYSTEMES MULTICONSTITUES, FAUTES LAMELLAIRES ET JOINTS DE PHASES] **c26**
Francis Durand *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 41-55 refs In FRENCH (For availability see N75-11034 02-24)

An evaluation was made of the solidification of biphase composites as a function of constituent alloys, and lamellar faults in relation to the structure in point phases. Data are included on theoretical ideas of equilibrium diagram limitations, solid composition analysis, and instability of the solid/liquid wall. Observations made of different mutual orientations, dislocations, and point orientation are included. Transl. by E.H.W.

N75-11039 Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
CRYSTAL GROWTH METHODS FOR THE PRODUCTION OF ALIGNED COMPOSITES **c27**
A. Hellawell *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 57-66 refs (For availability see N75-11034 02-24)

Reactions which are suitable for the production of aligned composite materials are listed and their applications briefly considered. The requirements of a growth technique and a product are outlined as they affect thermal stability and control, directionality and perfection of structure, composition and orientation control and problems of contamination. The advantages of various techniques are then discussed in terms of their useful application to the control of different phase transformations. Author

N75-11040 TRW, Inc., Cleveland, Ohio.
FORMING USEFUL DIRECTIONALLY SOLIDIFIED COMPOSITE SHAPES
J. A. Alexander and L. D. Graham *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 67-78 (For availability see N75-11034 02-24)

A selective review was conducted of available information relating to the fabrication of shapes from directionally solidified composites. The review is based upon information contained in the open literature in government contract reports. The summation of what was reported is augmented by discussions on what might be done to fabricate shapes from directionally solidified composites. An extensive study was made of the mechanical properties of the composites, and the potential for performance improvement in engine constructed from the materials. Author

N75-11041 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
EUTECTIC PHASE EQUILIBRIA **c26**
E. Blank *In* AGARD Specialists Meeting Directionally Solidified In-Situ Composites Aug. 1974 p 81-92 refs (For availability see N75-11034 02-24)

Computational and experimental paths to the determination of phase diagrams are discussed which are not in common use: computer calculation, use of directional solidification, and use of

diffusion techniques. Computer calculation of phase diagrams at present is confined to ternary systems. Although calculated phase boundaries often agree well with experimental values, the influence of the metallic solution models on the calculated results is not well understood. Generally, thermochemical data of the limiting binary systems are sufficient for the calculation of the ternary diagram. Ternary phases cannot be predicted a priori. Usually, they are limited to lines of specific stoichiometry. To lower costs computation should be carried out by a few specialists. - Experimentally, the influence of all alloying elements on the shape of the liquidus and solidus surfaces may be allowed for by a directional solidification technique. Some diffusion techniques appropriate to solid state reactions are elucidated. Author

N75-11042* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECTIONALLY SOLIDIFIED COMPOSITE SYSTEMS UNDER EVALUATION
Richard L. Ashbrook *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 93-115 refs (For availability see N75-11034 02-24)

Various types of high temperature in-situ composites were reviewed and attempts were made to determine which ones offer the most potential for future development. Some of the systems that were investigated according to the ductility of the component phases were categorized. The categories range from ductile-ductile to brittle-brittle. Examples in each category are considered with special emphasis on systems which look attractive for use in gas turbine engines. Data also touch on microstructure, mechanical properties, and process problems. Author

N75-11043 Pratt and Whitney Aircraft, East Hartford, Conn. Materials Engineering and Research Lab.
THERMAL STABILITY OF DIRECTIONALLY-SOLIDIFIED COMPOSITES
M. Gell *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 117-124 refs (For availability see N75-11034 02-24)

Microstructural and mechanical property stability under static and cyclic temperature exposure are two important requirements for turbine airfoil materials in advanced gas turbine engines. Under thermal cycling conditions, significant microstructural instability and mechanical property degradation was observed in a number of TaC-reinforced alloys, while the delta-reinforced alloys have exhibited greater stability. The physical and chemical properties of the eutectic promoting microstructural instability and the testing variables defining the severity of the thermal cycle are discussed. Author

N75-11044 Liverpool Univ. (England). Dept. of Metallurgy and Materials Science.
OXIDATION, HOT-CORROSION AND PROTECTION OF DIRECTIONALLY SOLIDIFIED EUTECTIC ALLOYS c26
John Stringer *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 131-140 refs (For availability see N75-11034 02-24)

The high temperature oxidation and corrosion behavior of directionally solidified eutectic alloys are discussed in general terms, and some simple models are presented of possible effects. Illustrations of these effects in real situations are shown. Author

N75-11045 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROSPECT OF DIRECTIONALLY SOLIDIFIED EUTECTIC SUPERALLOYS c26
Herve Bibring *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 141-155 refs In FRENCH; ENGLISH summary (For availability see N75-11034 02-24)

An evaluation was made of the possibilities offered by the utilization of more fully developed high temperature DS composites as aircraft blade materials. Two families of these materials are emphasized, namely: the lamellar intermetallic eutectics of the Ni3Al-Ni3Nb type recently broadened to the quaternary composition systems Co/Ni3Al-Ni3Nb with Cr additions, and the COTAC family of multicomponent fiber composites whose complex superalloy matrices are reinforced by in-situ aligned monocarbide whiskers. When compared to the best present day superalloys, both these families show an important gain in operational temperatures. Weak points, particularly noticeable in some of these new materials, such as lack of ductility poor corrosion resistance, and thermal cycling problems should be improved. Author

N75-11046 National Gas Turbine Establishment, Pyestock (England). Materials Science Dept.
COMPONENT DESIGN WITH DIRECTIONALLY SOLIDIFIED COMPOSITES
M. G. Cockcroft and P. H. Cowley *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 157-162 refs (For availability see N75-11034 02-24)

Directionally solidified eutectic materials (in situ composites) are examined in general terms from the point of view of their use in turbine blades for aero gas turbines. The special characteristics that must be taken into account in the design of blades are outlined and attention is drawn to areas where further information is required. It is concluded that the materials might readily be used for uncooled or lightly cooled blades but production problems will need to be overcome before they are used in heavily-cooled blades. Author

N75-11047 Advisory Group for Aerospace Research and Development, Paris (France).
MEETING SUMMARY AND OUTLOOK
E. R. Thompson, P. Sahm, and M. C. Flemings *In its* Specialists Meeting Directionally Solidified In-Situ Composites Aug. 1974 p 165-166 (For availability see N75-11034 02-24)

A summary is made of the accomplishments, conclusions, and problem areas encountered in the study of composites used in turbine blade construction. The systems considered include the following families: (1) Co-Cr7C3, (2) Co-TaC, (3) Ni/Ni3Al-TaC, (4) Ni3Al-Ni3Cb. E.H.W.

N75-11048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A THEORY FOR PREDICTING COMPOSITE LAMINATE WARPAGE RESULTING FROM FABRICATION
C. C. Chamis [1974] 35 p refs Proposed for presentation at the 30th Ann. Reinforced Plastics Composites Conf., Washington, D. C., 4-7 Feb. 1975; sponsored by the Soc. of the Plastics Ind.
(NASA-TM-X-71619; E-8134) Avail: NTIS HC $3.75 CSCL 11D

Linear laminate theory is used with the moment-curvature relationship to derive equations for predicting end deflections due to warpage without solving the coupled fourth-order partial differential equations of the plate. Composite micro- and macrohyphenmechanics are used with laminate theory to assess the contribution of factors such as ply misorientation, fiber migration, and fiber and/or void volume ratio nonuniformity on the laminate warpage. Using these equations, it was found that a 1 deg error in the orientation angle of one ply was sufficient to produce warpage end deflection equal to two laminate thicknesses in a 10 inch by 10 inch laminate made from 8 ply Mod-I/epoxy. Using a sensitivity analysis on the governing parameters, it was found that a 3 deg fiber migration or a void volume ratio of three percent in some plies is sufficient to produce laminate warpage corner deflection equal to several laminate thicknesses. Tabular and graphical data are presented which can be used to identify possible errors contributing to laminate warpage and/or to obtain an a priori assessment when unavoidable errors during fabrication are anticipated. Author

N75-11049*# Johns-Manville Research and Development Center, Denver, Colo. Insulations Div.
DEVELOPMENT OF IMPROVED ASBESTOS REINFORCED PHENOLIC INSULATING COMPOSITES (OPTIMIZATION OF PHYSICAL PROPERTIES AS A FUNCTION OF MOLDING TECHNIQUE AND POST CURE CONDITIONS) Technical Report, Oct. 1972 - Sep. 1973
L. M. Hedges, ed. Sep. 1973 257 p refs
(Contract NAS1-11490)
(NASA-CR-132416) Avail: NTIS HC $8.50 CSCL 11D

Detailed data are presented on phenolic-glass and phenolic-asbestos compounds which compare the effect of compression

molding without degas to the effects of four variations of compression molding. These variations were designed to improve elimination of entrapped volatiles and the volatile products of the condensate reaction associated with the cure of phenolic resins. The utilization of conventional methods of degas plus degas by vacuum and directional heat flow methods are involved. Detailed data are also presented on these same compounds, comparing the effect of changes in post-bake time, and post-bake temperature for the five molding techniques. Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N75-11050 Polish Academy of Sciences, Warsaw.
EFFECTS OF MOLECULAR ORIENTATION ON THE THERMODYNAMICS OF POLYMER CRYSTALLIZATION
Leszek Jarecki 1974 133 p refs In POLISH; ENGLISH summary
(Rept-29/1974) Avail: Issuing Activity

The internal energy and entropy of a deformed chain of molecules was calculated on the basis of the inverse Langevin distribution function. The distribution of rotational isomers was determined from minimization of free energy, and the local tension of the single chain was calculated. The general expression for enthalapy of deformation of the crystalline phase was derived and estimated for an orthotropic body with uniaxial symmetry. The crystallization enthalapy and entropy was calculated from the cycle of isothermal transformations. The equilibrium crystallization temperature was computed for uniaxial extensions of polyethylene and cis- polyisoprene curves. The kinetic crystallization characteristics of uniaxially extended polyethylene and cis-polyisoprene based on nucleation and crystal growth theory are also derived. Author

N75-11051*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A FLASH PHOTOLYSIS-RESONANCE FLUORESCENCE STUDY OF THE FORMATION OF O(D-1) IN THE PHOTOLYSIS OF WATER AND REACTION OF O(D-1) WITH H2, Ar AND He
Louis J. Stief, Walter A. Payne, and R. Bruce Klemm (NAS-NRC) Nov. 1974 47 p refs Submitted for publication
(NASA-TM-X-70784; X-691-74-320) Avail: NTIS HC $3.75 CSCL 07D

The relative importance of two primary processes in the photolyis of water: (1) H2O + h (nu) yields H + OH, and (2) H2O + h (nu) yields H2 + OD-1 were determined in a direct manner by time resolved detection (via resonance fluorescence) of H and O formed in processes 1 and 2 respectively. The initially formed OD-1 was deactivated to ground state OP-3 prior to detection via resonance fluorescence. The relative quantum yields for processes 1 and 2 are 0.89 and 0.11 for the wavelength interval 105 to 145nm and = to or greater than 0.99, and = to or less than 0.01 for the wavelength interval 145 to 185nm. Rate constants at 300 K for the reactions OD-1 + H2, + Ar, and + He are presented. Author

N75-11052*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
ION IMPLANTED EPITAXIALLY GROWN ZnSe Final Report
Nov. 1974 27 p refs
(Grant NGR-06-003-205)
(NASA-CR-140804) Avail: NTIS HC $3.75 CSCL 20B

The epitaxial growth of ZnSe on (100) Ge using the close-spaced transport process is described. Substrate temperature of 575 C and source temperatures of 675 C yield 10 micron, single crystal layers in 10 hours. The Ge substrates provides a nonreplenishable chemical transport agent and the epitaxial layer thickness is limited to approximately 10 microns. Grown epitaxial layers show excellent photoluminescence structure at 77 K. Grown layers exhibit high resistivity, and annealing in Zn vapor at 575 C reduces the resistivity to 10-100 ohms-cm. Zinc vapor annealing quenches the visible photoluminescence. Author

N75-11053# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
CRYSTAL GROWTH AND ELECTRO-OPTICAL CHARACTERIZATION OF BISMUTH TRI-IODIDE
M. M. Schieber, T. J. Davies, H. A. Lamonds, W. F. Schnepple, P. T. Randtke, and R. C. Carlston Apr. 1974 15 p refs Presented at the Meeting of the Am. Assoc. for Crystal Growth, San Diego, 17 May 1974
(Contract AT(26-1)-565)
(EGG-565-134; Conf-740527-1) Avail: NTIS HC $3.25

The purification and crystal growth from the vapor phase and some electro-optical characterization measurements of BiI3 are described. The sublimed boules had large single crystalline pieces which could be cleaved to give areas of about 1 cm in diameter and a thickness of about 1 mm. The grown crystals were measured for transmission from 0.6 microns to 50 microns reflection from 0.6 microns to 1 microns, energy band gap Eg, index of refraction, and some photoconductivity measurements. The Eg at room temperature and 78 K was found to be 1.78 and 2.09 eV, respectively, and the complex index of refraction at 1 micron wavelength is N = 3.13 - i(3.2 x 10 to the minus 5th power). Author

N75-11054# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF LIQUID SODIUM
M. E. Durham Jan. 1974 39 p refs
(RD/B/M-2479-Rev; CFR/THWP/P-(72)28-Rev) Avail: AEC Depository Libraries HC $5.00

The thermodynamic and transport properties of saturated liquid sodium are presented in graphical and tabular form. Analytic expressions are also given from which the value of the particular property may be found as a function of temperature. SI units are used throughout. The properties of the subcooled liquid can be assumed equal to those of the saturated liquid at the same temperature, with negligible error. Conversion factors are given which enable the data to be expressed in Imperial and cgs units. Author (NSA)

N75-11055# Sandia Labs., Albuquerque, N.Mex.
EFFECT OF INCREASING OXYGEN PRESSURE ON THE LUMINOSITY OF THE METAL-OXYGEN PHOTOFLASH REACTION
L. S. Nelson, C. J. M. Northrup, Jr., R. P. Wemple, N. L. Richardson, K. Keil, D. J. Fastle, and H. N. Planner Mar. 1974 91 p refs
(Contract AT(29-1)-789)
(SLA-73-1036) Avail: NTIS HC $4.75

The metal wool-oxygen photoflash reaction was studied in separate experiments for equimolar quantities of zirconium, hafnium, aluminum and hydrided zirconium (ZRH14) in oxygen at pressures from 1 to 125 atmospheres. The luminous emission was studied with photomultiplier and calibrated photographic spectroscopic techniques. The reactions were photographed with a high speed camera and the solid products were analyzed by optical microscopy and electron microprobe techniques. The light emitted in the zirconium-oxygen photoflash reaction increases in peak intensity (2-fold in the red to 4.5-fold in the blue), and decreases in pulse width and pulse asymmetry as the oxygen pressure is increased from 1 to 100 atmospheres. At the same time, the average peak brightness temperature increases from about 3600K to 4400K. The emission approximates a black-body to within + or - 3% even at the highest pressures, but the apparent temperature falls considerably below that predicted by the vapor pressure/temperature relationships given by Krieger. Author (NSA)

N75-11056# Commissariat a l'Energie Atomique, Grenoble (France).
GROWTH OF EPITAXIAL SUBSTITUTED GARNET FILMS BY HYDROTHERMAL SYNTHESIS

B. Ferrand, J. Geynet, D. Challeton, J. Daval, and J. C. Joubert 2 Nov. 1973 25 p refs Presented at the Conf. on Magnetic Bubbles, London, 5-7 Sep. 1973
(CEA-Conf-2595; Conf-730994-2) Avail: AEC Depository Libraries HC $4.25

The growth of magnetic garnet films by hydrothermal synthesis is reviewed. A new hydrothermal technique is described, which is based on the fact that the garnet synthesis is performed directly in the autoclave in weak basic concentrations (NaOH or KOH) avoiding a strong attack of the substrate and assuming uniform-thickness composition films. The best experimental conditions are given for growth of Ga: YIG, Gd: Ga: YIG, Eu: Ga: YIG, Eu: Ga: ErIG and Gd: Ga: ErIG. Magnetic observations are presented and the properties of hydrothermal garnet films are discussed and compared with those of liquid phase epitaxy and chemical vapor deposition garnet films. Author (NSA)

N75-11057# Commissariat a l'Energie Atomique, Montrouge (France).
INTRODUCTION OF LIQUID-VAPOR PHASE CHANGES INTO THE CHEMICAL EQUILIBRIA OF SILICA, ALUMINA, AND WATER AT HIGH TEMPERATURES
C. Humbert-Droz, R. Dehais, and A. Frey May 1974 16 p refs In FRENCH
(CEA-R-4520) Avail: AEC Depository Libraries HC $4.00

The changes at high temperature (3000 to 4000 K) in the number of molecules in the different phases of a mixture of silica, alumina, and water were studied using a chemical equilibrium system. The pressure conditions (1 to 500 bars) necessitated liquid gas phase changes and the taking into consideration of the variations in the concentration of each gas species as a function of its titer in the liquid. Author (NSA)

N75-11058# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
GRETEL: A COMPUTER PROGRAM FOR GAMMA RAY SPECTROMETRY WITH Ge(Li) DETECTORS
G. Guzzi and J. Cuypers Apr. 1974 76 p refs
(EUR-5117) Avail: AEC Depository Libraries HC $7.00; EUR B. Fr. 100.-

A computer program set up for routine batchwise processing of spectrometric data is presented. The program performs the quantitative analysis of gamma spectra obtained by Ge(Li) detectors, using special oriented libraries, which are prepared for each particular problem. The computer routines which detect and evaluate peak areas perform the following operations: local smoothing of the spectrum; first derivative of the smoothed spectrum; peak location according to the change of sign of the first derivative; and computation of the net area of each peak found. The possibility of detecting and computing also double peaks is one of the features of the program. Results in ppM are obtained in the form of digital lists. On request a drawing of the spectrum can also be produced, showing the way in which the spectrum has been processed. Author (NSA)

N75-11059# National Engineering Lab., East Kilbride (Scotland).
BIBLIOGRAPHY OF THE THERMAL CONDUCTIVITY AND VISCOSITY OF CARBON DIOXIDE
A. Mackay Apr. 1974 20 p refs
(NEL-563) Avail: AEC Depository Libraries HC $4.00

A list of references to and a data survey of the transport properties of carbon dioxide is presented. The data survey gives the range of pressure and temperature over which the data exist together with the methods of measurement employed.
Author (NSA)

N75-11060# Aerospace Corp., El Segundo, Calif. Lab Operations.
AUGER SPECTROSCOPY OF SILICONES Interim Report
Gary W. Stupian 16 Sep. 1974 28 p refs
(Contract F04701-74-C-0075)
(AD-784829; SAMSO-TR-74-189) Avail: NTIS CSCL 07/4

Silicon Auger spectra arising from a variety of silicon compounds, mostly silicones, have been studied. Silicones may be regarded, in a sense, as compounds intermediate between elemental silicon dioxide. The observed silicon Auger peak energies of silicones are found to lie between the Si (LMM) peak energies of Si and SiO2, and are correlated with the net electronic charge on silicon as estimated from a very simple model of charge transfer based on Pauling electronegativities.
Author (GRA)

N75-11061# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW TYPES AND FORMS OF CATALYSTS REACTIONS
S. Z. Roginskii 15 Aug. 1974 33 p refs Transl. into ENGLISH from Probl. Kinet. Katal. 15. Mekh. Kinet. Geterogennykh Raaktsii (USSR), 1973 p 12-27
(FTD Proj. T74-04-08)
(AD-784710; FTD-MT-24-1746-74) Avail: NTIS CSCL 07/4

The report surveys heterogeneous catalysts and catalysis. Included are sections on catalysts purified in ultravacuum, skeletal catalysts, non-transition element solid catalysts (including various organic and inorganic semiconductors), polymerization catalysts, and catalysts for new reactions. GRA

N75-11062# Ohio State Univ. Research Foundation, Columbus.
FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS, PART 2 Annual Report, 1 Mar. 1973 - 28 Feb. 1974
R. W. Staehle and J. B. Lunsden Jun. 1974 37 p refs
(Contract N00014-67-A-0232-0006; NR Proj. 036-085)
(AD-783089; OSURF-3003-5-Pt-2) Avail: NTIS CSCL 07/4

Film growth on iron was studied by ellipsometry in aerated and deaerated chromate solutions of different pH's at open circuit potentials and at various anodic potentials. It was found that various films can be formed depending on the experimental conditions. At high anodic potentials iron oxide is produced. At open circuit potential iron and chromium hydroxides are formed. The kinetics of the film growth at open circuit potentials is logarithmic and the kinetics of iron hydroxide formation follow the cubic law. Author (GRA)

N75-11063# Texas Univ., Austin. Dept. of Physics.
SURFACE VIBRATION MODES IN MONATOMIC BODY-CENTERED CUBIC CRYSTALS THE (001) SURFACE
V. Zoth Nov. 1973 184 p refs
(Grant AF-AFOSR-1973-71; AF Proj. 9761)
(AD-783259; TR-73-11-2; AFOSR-74-1256TR) Avail: NTIS CSCL 20/12

Surface vibration modes for the (001) surface of monatomic bcc crystals are examined using a simple model which allows for full cubic anisotropy and which exactly fits the second-order elastic constants. For both the semi-infinite crystal and the crystal slab approaches, the effect of anisotropy is examined for iron, vanadium and isotropic tungsten. For each crystal a surface mode with shear-horizontal (SH) polarization is found below the SH bulkband along the (100) direction but not along the (110) direction. For long wavelength, the frequency of this surface mode departs from the bulk band edge as the inverse cube of wavelength and the localization depth is proportional to the inverse square of wavelength. A surface mode with SH polarization is found above the SH bulkband in both the (100) and (110) directions for vanadium. In addition to the Rayleigh waves, a number of short wavelength surface modes with sagittal-plane polarization are found for each crystal. (Modified author abstract) GRA

N75-11064# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
AN X-RAY METHOD FOR THE DETERMINATION OF MOLYBDENUM IN LUBRICANTS
D. A. Lutz 19 Jul. 1974 10 p refs
(AD-783032; NADC-74071-30) Avail: NTIS CSCL 07/4

An X-ray fluorescence method for the determination of molybdenum in lubricants has been developed. This method is non-destructive, involves minimum sample preparation, and compares in precision with wet chemical methods. The method yields per cent of molybdenum as a function of the second order of K alpha C (1,2) molybdenum X-ray emission line above background. Author (GRA)

N75-11065# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IGNITION OF MAGNESIUM PARTICLES IN VARIOUS MEDIA

V. A. Fedoseev, V. E. Glushkov, and L. A. Sokolov 27 Jun. 1974 11 p refs Transl. into English from Fiz. Aerodispersnykh Sistem (USSR), no. 6, 1972 p 68-72
(FTD Proj. T74-04-05; FTD Proj. T74-04-06)
(AD-783563; FTD-HT-23-1214-74) Avail: NTIS CSCL 21/2

The combustion of metal particles was studied in which the induction period (tau sub i) is dependent on the size of the particles (a), as well as the temperature of the medium (T sub 0) The dependence of the particle ignition temperature on particle size (T sub beta a) was also examined. An analysis of the relation between tau sub i (a, T sub 0) and T sub beta (a) is presented, using the example of the ignition of magnesium particles of 1 micron to 100 microns in size, and occuring in the various mediums of air, steam, and nitrous oxide. A.A.D.

N75-11066# New York Univ., N.Y. Dept. of Chemistry.
EXPERIMENTAL METHODS FOR THE DETERMINATION OF THE PHOTOIONIZATION SPECTRUM OF SOLVATED ELECTRONS
H. Aulich, L. Nemec, and P. Delahay Jul. 1974 23 p refs Submitted for publication
(Contract N00014-67-A-0467-0019; NR Proj. 051-258)
(AD-783085; TR-26) Avail: NTIS CSCL 07/5

The paper covers the following experimental aspects: (1) Photoelectron emission cell and operation procedure; (2) Optical system and determination of photon flux; (3) Electronics and methodology; and, (4) Calibration of detectors with a quartz-iodine lamp calibrated by the National Bureau of Standards. (Modified author abstract) GRA

N75-11067# Air Force Weapons Lab., Kirtland AFB, N.Mex.
INVESTIGATION OF DECOMPOSITION CHARACTERISTICS OF GASEOUS AND LIQUID NITROUS OXIDE Final Report, 1 Aug. - 15 Dec. 1973
G. W. Rhodes Jul. 1974 50 p refs
(AF Proj. 1210; AF Proj. 1208)
(AD-784802; AFWL-TR-73-299) Avail: NTIS CSCL 07/4

This report is a compilation of data obtained from Rocketdyne Division and Pratt and Whitney Aircraft Division. The Rocketdyne study examined liquid nitrous oxide stability with contaminant materials ranging from metal oxides to polymers at a temperature just below the critical point. Based on gas chromatographic analysis, negligible decomposition of the N2O occurred in all cases. One material in these tests which showed degradation was polymer (AF-E-124X) developed for use with N2O4. In general, it is concluded that N2O stability to catalytic and chemical decomposition is greatly increased in the liquid versus the gaseous state. The Pratt and Whitney effort concentrated on the decomposition characteristics of both gaseous and liquid nitrous oxide. The experimental program evaluated the ignition, flame speeds of induced reactions, and quenching characteristics of the decomposition reaction. The results demonstrate that gaseous N2O can be ignited either by rapid compression or electric spark at elevated pressures. They also indicate that nitrous oxide may safely be handled under extreme conditions in the cooled liquid state but that great hazards exist in the gaseous condition at elevated pressure and/or temperature. (Modified author abstract) GRA

N75-11068# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE COPPER (2): CATALYZED LOW TEMPERATURE DECOMPOSITION OF AMMONIUM PERCHLORATE
J. Richard Ward Jun. 1974 18 p refs
(DA Proj. 1T0-61102-B-13A)
(AD-784073; BRL-MR-2390) Avail: NTIS CSCL 07/4

Although the mechanism of the thermal decomposition of pure ammonium perchlorate (an oxidizing agent in many solid propellants) seems well established, the mechanism by which certain materials catalyze the rate of decomposition is not as clear. A recent publication by Keenan and Siegmund on the catalysis of the low-temperature decomposition of ammonium perchlorate by copper (II) contain results which provide further evidence that a modification of the currently accepted mechanism is in order. In this report the mechanisms of the catalyzed and uncatalyzed decomposition of ammonium perchlorate are briefly reviewed, Keenan and Siegmund's results are presented, and the modification to existing mechanistic interpretations is discussed. GRA

N75-11069# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LATTICE DYNAMICAL MODEL OF IGNITION Final Report
Denis F. Strenzwilk Jun. 1974 30 p refs
(DA Proj. 1T0-61102-A-32C)
(AD-784076; BRL-1724) Avail: NTIS CSCL 21/2

The paper on a lattice dynamical model of ignition for molecular crystals is divided into three parts. In Part I the formal expression for the transition rate for a molecule in a crystal to absorb three phonons of lattice energy into the lowest frequency molecular vibrational mode (0 to 1 transition) is obtained. Then, the change in the transition rate of a perfect molecule, due to a nearest neighbor impurity, is discussed for some cases. Two separate examples of a microscopic hot spot are demonstrated. In Part II a simple microscopic model of a chemical reaction in a solid caused by vibrational excitation is formulated for a crystal composed of perfect inert molecules with a chemically reactive impurity. Part III concerns the planned extension to three dimensions of the previous calculation of the transition rate on the effect called resonance absorption. This theoretical calculation must be performed since the identification of the absorption mechanism depends on the comparison between the value of the experimental transition rate and the theoretical rate. (Modified author abstract) GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N75-11070# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
TECHNICAL HIGHLIGHTS OF THE METALLURGY DIVISION
1974 113 p refs
Avail: NTIS HC $5.25

Activities are reported of the NBS metallurgy division. Sections include: mechanical properties, alloy physics, lattice defects and microstructures, corrosion and electrodeposition, metal physics, crystallization of metals, and specimen preparation. M.C.F.

N75-11071# Royal Aircraft Establishment, Farnborough (England).
FATIGUE CRACKS IN COPPER SINGLE CRYSTALS
J. Donch and P. Haasen Aug. 1974 19 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 62, no. 11, 1971 p 780-786
(RAE-Lib-Trans-1786; BR43421) Avail: NTIS HC $3.25

Rectangular copper single crystals of different orientations were fatigued in a symmetrical tension-compression test at 50 c/s with a shear stress of 3.2 kgf/sq mm at 292 K. After a linearly time dependent stress increase the plastic strain decreased with increasing number of cycles N at constant stress (strain-hardening). With the onset of cracking, the control was set to a constant plastic strain amplitude such that a low rate of crack propagation and, planar crack faces were obtained which were investigated by light and scanning electron microscopy. The crack was initiated on those faces of the specimen on which the persistent slip bands formed the largest extrusion, and it was always located on that side of the persistent slip band which had the smaller radius of curvature. The crack propagation may be described in terms of a shear stress distribution on slip planes intersecting the crack tip. - Author

N75-11072# Royal Aircraft Establishment, Farnborough (England).
RECENT DEVELOPMENTS AND DESIGN CRITERIA OF TITANIUM ALLOYS FOR THE AERONAUTICAL INDUSTRIES
R. Molinier, L. Seraphin, R. Tricot, and R. Castro Aug. 1974 34 p refs Transl. into ENGLISH from Rev. Met. (Paris), v. 71, no. 1, 1974 p 1-17
(RAE-Lib-Trans-1789; BR43391) Avail: NTIS HC $3.75

Developments in the titanium industry to improve the fabrication characteristics and performance of alloys for engines and structures are examined. The progress and trends in the use of the alloys are considered. Author

N75-11073*# Scientific Translation Service, Santa Barbara, Calif.
COMMENTS ON CURRENT TRENDS IN RESEARCH ON THE STRUCTURAL STABILIZATION OF AUSTENITIC STEELS CONTAINING MANGANESE
M. Martenet Washington NASA Nov. 1974 9 p Transl. into ENGLISH from Mem. Sci. Rev. Met. (France), v. 68 no. 11 Nov. 1971 p 771-772
(Contract NASw-2483)
(NASA-TT-F-16040) Avail: NTIS HC $3.25 CSCL 11F

Ways by which austenitic steels may be stabilized are reviewed. The addition of a certain amount of nickel, chilling by stages, and elimination of phosphorous, which causes embrittlement, are included. The research is based on the assumption that the intent of the metallurgist is to develop a manganese steel of fine austenitic structure which, after overtempering, is sufficiently stable to maintain in service the toughness which it owes to this structure, but at the same time is sensitive to martensitic transformation by hammer hardening. Author

N75-11074# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
STRENGTHENING MOLYBDENUM BY POWDER METALLURGICAL INTERNAL OXIDATION OF ZrMo2
W. L. OBrien and R. Blickensderfer 1974 18 p refs
(BM-RI-7958) Avail: NTIS HC $3.25

Molybdenum alloys with good strength properties at elevated temperatures were produced by a powder metallurgical internal oxidation method known as oxyreaction strengthening. Commercial molybdenum powders were blended with 0 to 10% of a reactive powder, ZrMo2. The effects of composition, blending procedure, and sintering conditions on strength properties at elevated temperatures were studied. Strengthening was attributed to zirconium in solid solution with molybdenum and to the presence of submicrometer particles of ZrO2. Several alloys had tensile strength and stress-rupture properties comparable with those of the best commercial alloys. The maximum tensile strengths obtained were 92 kpsi at 1,200 C and 53 kpsi at 1,316 C. The maximum stress-rupture life at 30 kpsi and 1,200 C was 145 hours. Author

N75-11075*# TRW Equipment Labs., Cleveland, Ohio.
FABRICATION OF TUNGSTEN WIRE REINFORCED NICKEL-BASE ALLOY COMPOSITES
W. D. Brentnall and I. J. Toth Oct. 1974 60 p refs
(Contract NAS3-16756)
(NASA-CR-134664; ER-7757) Avail: NTIS HC $4.25 CSCL 11/6

Fabrication methods for tungsten fiber reinforced nickel-base superalloy composites were investigated. Three matrix alloys in pre-alloyed powder or rolled sheet form were evaluated in terms of fabricability into composite monotape and multi-ply forms. The utility of monotapes for fabricating more complex shapes was demonstrated. Preliminary 1093C (2000F) stress rupture tests indicated that efficient utilization of fiber strength was achieved in composites fabricated by diffusion bonding processes. The fabrication of thermal fatigue specimens is also described. Author

N75-11076*# Mar-Test, Inc., Cincinnati, Ohio.
HIGH-TEMPERATURE, LOW-CYCLE FATIGUE OF ADVANCED COPPER-BASE ALLOYS FOR ROCKET NOZZLES. PART 2: NASA 1.1, GLIDCOP, AND SPUTTERED COPPER ALLOYS Contractor Report, Mar. - Sep. 1974
J. B. Conway, R. H. Stentz, and J. T. Berling Nov. 1974 50 p
(Contract NAS3-17777)
(NASA-CR-134628; MTI-R004-3-1-Pt-2) Avail: NTIS HC $3.75 CSCL 11F

Short-term tensile and low-cycle fatigue data are reported for five advance copper-base alloys: Sputtered Zr-Cu as received, sputtered Zr-Cu heat-treated, Glidcop AL-10, and NASA alloys 1-1A and 1-1B. Tensile tests were performed in argon at 538 C using an axial strain rate of 0.002/sec. Yield strength and ultimate tensile strength data are reported along with reduction in area values. Axial strain controlled low-cycle fatigue tests were performed in argon at 538C using an axial strain rate of 0.002/sec to define the fatigue life over the range from 100 to 3000 cycles for the five materials studied. It was found that the fatigue characteristics of the NASA 1-1A and NASA 1-1B compositions are identical and represent fatique life values which are much greater than those for the other materials tested. The effect of temperature on NASA 1-1B alloy at a strain rate of 0.002/sec was evaluated along with the effect of strain rates of 0.0004 and 0.01/sec at 538 C. Hold-time data are reported for the NASA 1-1B alloy at 538 C using 5 minute hold periods in tension only and compression only at two different strain range values. Hold periods in tension were much more detrimental than hold periods in compression. Author

N75-11077# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
GRAIN BOUNDARY SLIDING DURING HIGH TEMPERATURE CREEP
T. G. Langdon Feb. 1974 14 p refs
(Contract AT(04-3)-113)
(USC-113-P-26-X-1) Avail: NTIS HC $3.25

Preliminary results for the activation energy for grain-boundary sliding in Mg-0.8% Al indicate that it is very close to that for the total creep process. Theoretical research is also reported on creep and stacking fault energies. NSA

N75-11078# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
STUDY OF DISLOCATION DYNAMICS ASSOCIATED WITH DUCTILE-BRITTLE TRANSITION AND HYDROGEN EMBRITTLEMENT PHENOMENA OBSERVED IN BCC METALS Annual Technical Progress Report
W. W. Gerberich and D. G. Atteridge Mar. 1974 220 p refs
(Contract AT(11-1)-2212)
(COO-2212-2; ATPR-2) Avail: NTIS HC $7.25

Laboratory setups for acoustic emission and stress-wave emission capabilities allows the recording of dislocation and cracking events. Stress relaxation, dynamic loading, load drop, crack-opening displacement, and other detailed flow and fracture tests can be run. Environmental setups include low-temperature and gaseous environment capabilities. Theoretical and experimental analysis were carried out of both stress-intensity threshold and crack growth rate which are conditions for hydrogen-assisted cracking. Several test programs have evolved which should resolve the role of both the stress field and the long-range diffusion of hydrogen in the embrittlement process. The ability to associate a single stresswave emission with a single discontinuous fracture event of finite area was developed, enabling in-situ studies of such growth processes. NSA

N75-11079# Massachusetts Univ., Amherst.
ULTRASONIC ATTENUATION STUDIES OF THE ELECTRONIC STRUCTURE OF METALS Progress Report, 1 Jun. 1973 - 31 May 1974
A. R. Hoffman 1974 9 p refs
(Contract AT(11-1)-3331)
(COO-3331-6) Avail: NTIS HC $3.25

Measurements of the thermal conductivity (K) in two Be samples is proceeding. K has been accurately measured in the purer sample (residual resistivity ratio approximately 2000) from 1.5 to 40 K and the expected maximum in K variation with temperature was observed at 36 K. Preliminary measurements of K as a function of magnetic fields up to 65 kOe were made at several temperatures ranging from 4 to 14 K. Author (NSA)

N75-11080# California Univ., Los Angeles. School of Engineering and Applied Science.
BRAGG-WILLIAMS AND OTHER MODELS OF THE OMEGA PHASE TRANSFORMATION
D. Defontaine and R. Kikuchi (Hughes Res. Lab., Malibu, Calif.) Dec. 1973 33 p refs
(Contract AT(04-3)-34)
(UCLA-34-P-201-9) Avail: NTIS HC $3.75

Various previously proposed models of the beta yields omega phase transformation in Ti, Zr, Hf alloys are briefly reviewed. A new Bragg-Williams model of the displasive order-disorder

transition is introduced in the single-variant approximation. A closed-form free energy expression is derived which exhibits typical first-order characteristics. A quantitative but approximate prediction is made for the temperature dependence of the long-range order parameter. This parameter measures the degree of advancement of (111)-plane collapse or, equivalently, the amplitude of the 2/3/111/omega wave. Author (NSA)

N75-11081# Cornell Univ., Ithaca, N.Y.
GRAIN BOUNDARIES IN THIN-FILM BICRYSTALS OF SURFACE-REACTIVE METALS PREPARED BY VACUUM WELDING
W. R. Wagner and R. W. Balluffi Mar. 1974 14 p refs
(Contract AT(11-1)-3158)
(COO-3158-30; Rept-2179) Avail: NTIS HC $3.25

A technique for preparing thin film bicrystal specimens of surface reactive metals containing grain boundaries of controlled geometry was developed. Epitaxial films were deposited on oriented substrates and were then welded together face-to-face in situ under vacuum. Low angle twist boundaries in copper and aluminum prepared by this technique contained grids of primary dislocations as shown by transmission electron microscopy. Grids of secondary grain boundary dislocations were detected in high angle <111> twist boundaries at twist angles near the high coincidence density E3 misorientation. The potential use of the technique in the study of interphase interfaces was pointed out. Author

N75-11082# Virginia Univ., Charlottesville. Dept. of Physics.
DYNAMIC DISLOCATION PHENOMENA IN SINGLE CRYSTALS OF METALS AND ALLOYS Final Report
J. W. Mitchell 1973 46 p refs
(Contract AT(40-1)-3808)
(ORO-3808-28) Avail: NTIS HC $3.75

The study comprised nine areas on: the growth and characterization of single crystals of alpha phase copper-aluminum alloys of high purity and perfection; the second and third order elastic constants of these alloys as a function of composition; source activation and dislocation motion in the earliest stages of plastic deformation immediately below the yield point; the dislocation mechanism involved in the formation of bands of deformation at the yield point; dynamic dislocation phenomena and mean dislocation velocities during the formation of bands of deformation at the yield point; internal stress distributions associated with arrays of dislocations; the mechanical properties of dilute ternary copper alloys such as the copper-aluminum-nickel alloy system; the factors determining the limiting velocities and frictional forces acting on dislocations from measurements of ultrasonic attenuation; and the factors determining the resistivity increment due to edge dislocations in alloys. NSA

N75-11083# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Material Science.
DISLOCATION MOBILITIES IN ORDERED ALLOYS Annual Progress Report
D. P. Pope 26 Mar. 1974 21 p
(Contract AT(11-1)-3407)
(COO-3407-8) Avail: NTIS HC $3.25

Dislocation velocity measurements carried out on Cu3Au at 298 and 77K show that dislocations do not move until the applied stress is approximately the macroscopic yield stress, and when that stress is reached the velocity increases rapidly with stress. The velocity-stress relations measured at 77 and 298K are not very different. This mobility data was used to reinterpret the anomalous temperature dependence of the yield stress and work hardening rates in L 1 sub 2 alloys. It is shown that the low temperature yield stress is probably determined by the antiphase boundary energy, and the increasing yield stress with temperature (in alloys that do not disorder) is related to a cross-slip pinning mechanism. The work hardening rates are determined by a combination of cross slip-pinning and antiphase boundary tkbe hardening. Author (NSA)

N75-11084# Cornell Univ., Ithaca, N.Y.
HYDROGEN GAS EMBRITTLEMENT
H. H. Johnson Nov. 1973 18 p refs Presented at the Conf. on Hydrogen in Metals, Pittsburgh, 23 Sep. 1973 Sponsored by AEC
(COO-3166-8; Conf-730992-2; Rept-2121) Avail: NTIS HC $3.25

The basic characteristics of the brittleness induced in many alloys by hydrogen gas are reviewed, discussed, and contrasted with the characteristics of classical hydrogen brittleness. The diffusion penetration distance of hydrogen ahead of a moving crack is estimated. The influence of elastic stresses and plastic deformation upon hydrogen distribution is qualitatively assessed. Author (NSA)

N75-11085# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
STEADY STATE CREEP CHARACTERISTICS OF Fe-3.5 AT PERCENT Mo ALLOY AT HIGH TEMPERATURES
H. Oikawa, S. Karashima, and M. Maeda [1974] 12 p refs Transl. into ENGLISH from J. Jap. Inst. Metals, v. 37, no. 6, 1973 p 599-603 Sponsored by AEC
(ORNL-TR-2819) Avail: NTIS HC $3.25

The deformation structure, internal stress, and relaxation behavior of Fe-3.5 at. % Mo alloy in the steady state creep process at 850 C were investigated, and the following results were obtained: (1) No outstanding differences in the creep structure were seen compared to that seen in Alpha-Fe. (2) The internal stress was at a very low level and was of a nearly constant value independent of the external stress. (3) The effective stress index of the steady state creep rate was about 2.7 while the effective stress index of the subgrain dislocation density was about 1j5. (4) The relationship sigma * varies directly as exp (-t) is valid between effective stress sigma * and time t in stress relaxation experiments directly after creep. (5) It may be said that the creep deformation of Fe-3.5 at. % Mo alloy at 850 C and stress of 1.1 to 4.0 kg/sq mm is controlled by an essentially model microcreep mechanism as the rate-determining process. Author (NSA)

N75-11086# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
NMR IN DILUTE ALLOYS
K. Tompa 1974 22 p refs Presented at Meeting of Intern. Soc. of Magnetic Resonance, Bombay, Jan. 1974
(KFKI-74-8; Conf-740125-1) Avail: AEC Depository Libraries HC $4.25

Electric field gradient and local magnetic field measurements around substitutional impurities in Cu-based dilute alloys are reviewed. NSA

N75-11087# European Atomic Energy Community, Brussels (Belgium). Bureau Eurisotop.
DETERMINATION OF NITROGEN IN REFRACTORY METALS: ITS TECHNOLOGICAL AND ECONOMIC IMPORTANCE
P. Albert May 1974 72 p refs In FRENCH
(EURISOTOP-90) Avail: AEC Depository Libraries HC $6.75

On the basis of inquiries made of the principal manufacturers and fabricators of Nb, Ta, Mo, W, V, Ti, and Zr, an attempt was made to define the technological importance and economic aspects of the determination of N in these refractory metals. The classical chemical and extraction methods are summarized. Laboratory methods developed in recent years include fusion under vacuum or carrier gas, spectrometry, activation analysis, and nuclear reaction analysis. These methods are compared. NSA

N75-11088# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
CORROSION OF METALS IN THE ATMOSPHERE
W. K. Boyd and F. W. Fink Aug. 1974 86 p refs
(Contract DSA900-74-C-0616)
(AD-784943; MCIC-74-23) Avail: NTIS HC $12.50 (special price)/MF $12.50 (special price) CSCL 11/6

This state-of-the-art report summarizes the main corrosion characteristics of the commercial metals commonly employed for external applications. Some of the factors that affect metal behavior in general are discussed at the outset, but since each metal has a characteristic response to the corrosive consitituents in external atmospheres, some of these factors are again discussed in the sections on the individual metals. Included in this report are sections dealing with carbon, weathering and

stainless steels, aluminum-alloys, copper-base alloys, and zinc and zinc-coated steel. GRA

N75-11089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POST-TAPPING IN VACUO ALUMINOTHERMIA

V. L. Kuznetsov, A. S. Dubrovin, and G. F. Ignatenko 29 Jul. 1974 16 p refs Transl. into ENGLISH from Proizvod. Ferrosplavov (USSR), no. 1, 1972 p 90-97-

(AD-784250; FTD-HT-23-1852-74) Avail: NTIS CSCL 11/6

Smelting aluminothermal alloys in vacuo makes it possible to lower gas saturation of the alloys and its content of non-ferrous metals. The effect of rarefaction on the rate of metallothermic processes has been studied. The purpose of the present work is to determine the effect of rarefaction on the extraction of metal in ingots. GRA

N75-11090# Liverpool Univ. (England). Dept. of Metallurgy and Materials Science.

HOT CORROSION OF NICKEL-BASE ALLOYS CONTAINING ALUMINUM AND MOLYBDENUM Interim Scientific Report, 15 May 1973 - 14 May 1974

John Stringer, M. E. ElDahshan, and D. P. Whittle 30 May 1974 31 p refs

(Grant AF-AFOSR-2388-72; AF Proj. 9769)

(AD-784932; EOARD-TR-75-5; ISR-2) Avail: NTIS CSCL 11/6

The effects of pre-sulfidation in H2 - 10% H2S mixtures, where the sulfur activity is sufficient to form nickel and chromium sulfides, on the oxidation behaviour of a series of Ni-Cr, Ni-Cr-Al, Ni-Cr-Mo and Ni-Cr-Al-Mo alloys was investigated. In binary Ni-15Cr alloys the presence of dispersed chromium sulfides in the alloy preclude the formation of a continuous Cr2O3 layer. The presence of molybdenum and to a lesser extent aluminum in the alloy increases the extent of attack after pre-sulfidation, particularly the depth of penetration of internal sulfides. Neither element is particularly deleterious under direct oxidation conditions, at least in flowing atmospheres. The technique of a brief pre-sulfidation treatment followed by oxidation is able to produce corrosion morphologies strikingly similar to those observed in practical hot corrosion conditions and it seems probable that the role of sulfur has been underestimated in recent mechanistic investigations. Author (GRA)

N75-11091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF ADDITIONAL ALLOYING OF THE PROPERTIES OF THE ALLOYS OF THE Mg-Li-Al SYSTEM

M. E. Drits 29 Jul. 1974 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), no. 1, 1967 p 120-124

(AD-784261; FTD-HC-23-1785-74) Avail: NTIS CSCL 11/6

The authors examine the results of the alloying of the alloy Mg - 5% Li - 5% Al with comparatively small additions of Zn, Mn, Ag, Cd, Ni, Ca, Ce, La, Nd and Y. The effect of the above elements on the mechanical properties of the alloy was studied in heat-compressed conditions after keeping them at 100C for one hundred hours, and at room temperature for six months. This made it possible to evaluate the stability of the properties of the alloys investigated under both excess (up to 100C) and normal temperature conditions. Microstructure is discussed. GRA

N75-11092# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Annual Report, 1 Mar. 1973 - 28 Feb. 1974

R. W. Staehle and J. B. Lumsden Jun. 1974 28 p refs

(Contract N00014-67-A-0232-0006; NR Proj. 036-085)

(AD-784605; OSURF-3003-5-Pt-3) Avail: NTIS CSCL 11/6

The formation of anodic films in tungstate solutions of pH 7.4, 10 and 12 at temperatures of 0, 20, 50 and 90C was studied using simultaneous electrochemical and ellipsometric techniques. It was found that the anodic film is composed of two or more layers. An iron oxide of 10-15 A in thickness exists on the iron surface. On the top of the iron oxide layer a second film is formed, probably composed of a double oxide, Fe2O3WO3. This second layer is much thicker, 200-300 A. Author (GRA)

N75-11093# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Annual Report, 1 Mar. 1973 - 28 Feb. 1974

R. W. Staehle and J. B. Lumsden Jun. 1974 56 p refs

(Contract N00014-67-A-0232-0006; NR Proj. 036-085)

(AD-784606; OSURF-3003-5-Pt-4) Avail: NTIS CSCL 11/6

The effects of temperature on the film covered electrode have been outlined. Where there are no data, temperature dependencies have been extrapolated and trends have been suggested. The significant components of consideration of product layer films have also been outlined in some detail. Author (GRA)

N75-11094# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF WEAR-RESISTANCE IN NITRIDED ELECTROLYTIC COATINGS ON SOME ALLOYED STEELS

V. I. Arkharov and Sh. Kh. Yar-Mukhamedov 9 Jul. 1974 9 p ref Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. Fiz.-Tekhn. Matematichni Nauki (Kiev), no. 12, 1972 p 1112-1115

(AD-782831; FTD-HC-23-2122-74) Avail: NTIS CSCL 11/3

Electrolytic chromium coatings of cylindrical samples of steel 38 ChGM and 38 ChGN underwent oil-hardening and after measurement of microhardness were tested for durability. Results are discussed. GRA

N75-11095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH-TEMPERATURE PROTECTIVE COATINGS OF REFRACTORY MELTS Mo, W, Nb, Ta, AND ALLOYS BASED ON THEM

A. V. Byalobzhezkii and M. S. Tsirlin 18 Jun. 1974 73 p refs Transl. into ENGLISH from Korroz. i Zaschchita ot Korrozii (USSR), v. 1, 1971 p 213-264

(FTD Proj. T74-01-10)

(AD-783057; FTD-MT-24-724-74) Avail: NTIS CSCL 11/6

As a result of the investigations at the present time in the scope of the development of high-temperature protective coatings for W, Ta, Mo and Nb determinable successes have been achieved. The complex silicide coatings insure the reliable performance of these materials up to temperatures of 1300-1800C; however, their service life thus far is short and at high (above 1400C) temperatures is limited to a dozen hours. For the protection of the big four metals at temperatures above 2000C the high-enthalpic oxides of ThO2, HfO2, ZrO2 and cermets on their bases are promising. Investigations are necessary on the thermodynamic properties of the substances which are included in the composition of protective coatings (oxides, silicides, etc.) at temperatures on the order of 1500-2000C and higher. GRA

N75-11096# Army Foreign Science and Technology Center, Charlottesville, Va.

ANODIC POLARIZATION OF NICKEL IN ALKALI METAL CARBONATES

O. P. Penyagina, I. N. Ozeryanaya, M. V. Smirnov, and B. S. Shibanov 24 Dec. 1973 10 p refs Transl. into ENGLISH from Tr. Inst. Elektrokhim., Akad. Nauk SSSR, Ural. Filial (USSR), no. 17, 1971 p 87-93

(AD-784159; FSTC-HT-23-1343-73) Avail: NTIS CSCL 07/4

Anodic polarization of nickel in a molten triple eutectic mixture of alkali metal carbonates was studied at 600-800 C. It was shown that the self-diffusion current of nickel is small in a melt of alkali metal carbonates, in the absence of thermal dissociation. At higher current densities, migration of nickel into the melt is accompanied by formation of a film which is difficult to dissolve, of nickel monoxide (600 C) or a solid solution of Li2O-NiO (800 C), which inhibits the process of anode solution of the metal. It was determined that the solid LiO2-NiO film passivates nickel more strongly than the friable nickel monoxide, which retards nickel oxidation negligibly. GRA

N75-11036 Toronto Univ. (Ontario). Dept. of Metallurgy and Materials Science.
THE STRUCTURE AND THERMAL STABILITY OF EUTECTIC ALLOYS
G. C. Weatherly *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 13-20 refs (For availability see N75-11034 02-24)

N75-11038 Domaine Univ., Saint Martin d,Heres (France). Lab. de Thermodynamique et Physico-Chimie Metallurgiques.
ORIENTATION SOLIDIFICATION OF BIPHASE COMPOSITES: CASE OF MULTICONSTITUENT SYSTEMS, LAMINAR AND POINT DEFECT PHASES [SOLIDIFICATION ORIENTEE DE COMPOSITES BIPHASE: CAS DES SYSTEMES MULTICONSTITUES, FAUTES LAMELLAIRES ET JOINTS DE PHASES]
Francis Durand *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 41-55 refs In FRENCH (For availability see N75-11034 02-24)

N75-11041 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
EUTECTIC PHASE EQUILIBRIA
E. Blank *In* AGARD Specialists Meeting Directionally Solidified In-Situ Composites Aug. 1974 p 81-92 refs (For availability see N75-11034 02-24)

N75-11044 Liverpool Univ. (England). Dept. of Metallurgy and Materials Science.
OXIDATION, HOT-CORROSION AND PROTECTION OF DIRECTIONALLY SOLIDIFIED EUTECTIC ALLOYS
John Stringer *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 131-140 refs (For availability see N75-11034 02-24)

N75-11045 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROSPECT OF DIRECTIONALLY SOLIDIFIED EUTECTIC SUPERALLOYS
Herve Bibring *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 141-155 refs In FRENCH; ENGLISH summary (For availability see N75-11034 02-24)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N75-11097# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF STRUCTURAL FEATURES ON THE PHYSICAL PROPERTIES OF CROSS-LINKED EPOXY RESINS
H. Batzer, F. Lohse, and R. Schmid Aug. 1974 71 p refs Transl. into English from Angew. Makromol. Chem. (Switzerland), v. 29/30, 1973 p 349-411
(RAE-Lib-Trans-1763; BR43277) Avail: NTIS HC $4.25

With the epoxy polyaddition system some fundamental relations between chemical structure and physical properties of cross-linked materials are shown. It became evident, that the morphology of the polymers is characteristically influenced not only by the segments between the cross-links but also by the cross-linking fragments formed during the polyaddition reaction. Amine-cured epoxy systems show distinct Beta-relaxations causing higher toughness and flexibility as well as higher glass transition temperatures than the anhydridecured polymers. Similar systems result by cross-linking epoxidised cycloolefins with aliphatic polycarboxylic acids. The importance of the structure of the segments in positions between the cross-links is shown by the specific resin/hardener compositions. The influence of the network structure on the physical properties of the cured specimen is demonstrated by the degree of curing, cross-linking density, structural symmetry of the agents used, the molecular orientation and crystallization. Author

N75-11098*# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF AUTOCLAVABLE POLYIMIDES
M. K. ORell, C. H. Sheppard, R. W. Vaughan, and R. J. Jones 21 Nov. 1974 104 p refs
(Contract NAS3-17770)
(NASA-CR-134716; TRW-24675-6012-RU-00) Avail: NTIS HC $5.25 CSCL 97C

A poly(Diels-Alder) (PDA) resin approach was investigated as a means to achieve autoclavability of high temperature resistant resin/fiber composites under mild fabrication procedures. Low void content Type A-S graphite reinforced composites were autoclave fabricated from a PDA resin/fiber prepared from an acetone:methanol:dioxane varnish. Autoclave conditions were 477K (400F) and 0.7 MN/sq m (100 psi) for up to two hours duration. After postcure at temperatures up to 589K (600F), the composites demonstrated high initial mechanical properties at temperatures up to 561K (550F). The results from isothermal aging studies in air for 1000 hours indicated potential for long-term (> 1000 hours) use at 533K (500F) and shorter-term (up to 1000 hours) at 561K (550F). Author

N75-11099# Sandia Labs., Livermore, Calif.
GAS MIGRATION IN GLASS
J. E. Shelby Mar. 1974 33 p refs Presented at the Struct. of Glass Conf., Troy, N. Y., Apr. 1974
(Contract AT(29-1)-789)
(SLL-74-5210; Conf-740417-1) Avail: NTIS HC $3.75

Inert gas mobility and solubility are primarily determined by the accessible free volume of the glass structure. As a result, the compositional dependence of gas mobility in a given family of glasses is a function of the effect of compositional changes on the structure and is not determined simply by the concentration of network formers. The effect of thermal history on gas mobility can be explained in a similar fashion; volume relaxation results in a corresponding mobility relaxation. Phase separation affects gas mobility, applied tensile stress increases gas mobility near the breaking stress of the specimen, and compressive and shear stress have no effect on gas mobility. Hydrogen behaves like an inert gas at low temperatures, but reacts to form hydroxyl at higher temperatures. Author (NSA)

N75-11100# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
EPOXY RESIN-CTBN ENCAPSULANT
K. E. Creed 14 May 1974 39 p refs
(Contract AT(29-2)-656)
(GEPP-125) Avail: NTIS HC $3.75

A recognized phenomenon that occurs with many rigid thermosetting epoxy resin systems is internal fracturing and cracking during environmental load testing. Since these cracks can create paths for high voltage breakdowns or component failure in products, their presence in the encapsulant can be the basis for rejection of products. Research produced evidence that the addition of carboxyl-terminated butadiene/acrylonitrile copolymers (CTBN) to the resin provides a more flexible encapsulant. Tests performed to determine a suitable mix and to measure the mechanical, electrical, and thermal parameters of the resin are described. The tests show a slight degradation of the mechanical, electrical, and thermal parameters of the more flexible resin; however, impact and shock capabilities improved. Author

N75-11101# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
STRESSES ON ENCAPSULATED GLASS VACUUM TUBE AND HEADER
R. K. Spears and V. Lusis 18 Jun. 1974 16 p refs
(Contract AT(29-2)-656)
(GEPP-130) Avail: NTIS HC $3.25

An experimental stress analysis was performed on neutron tubes encapsulated in an epoxy resin to determine (1) if the stress on the header of the tube is sufficient to cause delamination from the encapsulant and (2) how a 1/2-inch vertical scratch purposely placed in the glass tube frame affects the state of stress. Electric strain gages were placed on the header and along the glass frame; then strain measurements were made at temperatures ranging from -65F to +200F after the unit was encapsulated and taken out of the mold. The results indicate

that the header has a tendency to severely dish as the unit temperature approaches -65F. At most temperatures, the tangential stress was compressive near the top of the tube frame and became tensile at the midsection of the tube.
Author (NSA)

N75-11102# General Electric Co., St. Petersburg, Fla. Dept. of Neutron Devices.
EFFECTS OF TOLUENE AND POLYSULFIDE ON SEMIRIGID INSPECTION RESIN
K. E. Creed [1974] 11 p
(Contract AT(29-2)-656)
(GEPP-115) Avail: NTIS HC $3.25

The effect of toluene and a polysulfide containing toluene on semirigid inspection resin is studied. Both induced softening. Test specimens with the polysulfide rubber showed a significant reduction of tensile strength. It was concluded that protection could be achieved by use of a zinc undercoat. Author

N75-11103# Battelle Columbus Labs., Ohio.
CHARACTERISTICS OF SPRAY DRIED GRANULES AS RELATED TO CONTROL OF CERAMIC STRENGTH BEHAVIOR
G. K. Bansal and W. H. Duckworth Aug. 1974 15 p refs
(Contract N00014-73-C-0408; NR Proj. 032-541)
(AD-784688; TR-2) Avail: NTIS CSCL 11/2

A central problem in structural designing with brittle materials results from an observed size dependence of fracture stress and a related or accompanying stress-distribution dependency. The ultimate goal of this project is to define and explain size-strength relationships exhibited by ceramics that are of interest for Navy structural applications. In the interest of obtaining strength reproducibility in specimens machined from billets of a dry-pressed high-alumina ceramic, physical characteristics of spray-dried granules from several production batches were determined. Appreciable batch-to-batch variation was found in the size distribution, compaction behavior (including tap density), and crushing strength of the granules. Also, it was found that the batches varied with respect to the presence of occasional granules containing large pores (i.e., hollow granules). GRA

N75-11104# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.
FRACTURE STRENGTH OF SODA-LIME GLASS AFTER ETCHING
Robert H. Doremus and Edward K. Pavelchek Jun. 1974 26 p refs
(Contract N00014-67-A-0117-0014; NR Proj. 023-531)
(AD-783086) Avail: NTIS CSCL 11/2

The strength of soda-lime glass at liquid nitrogen temperature after various amounts of etching was measured. A median crack length of 6 micrometers was calculated from the results and a model of the etching process. It was found that the rate of etching at the crack tip was much lower than on the external surface. Measured distributions of strength for samples etched different depths were also in reasonable agreement with calculated distributions. The etching process itself was found to cause some weakening of the glass. Author (GRA)

N75-11105# Rock Island Arsenal Lab., Ill. General Thomas J. Rodman Lab.
TEST METHOD FOR ESTIMATING THE HYDROLYTIC STABILITY OF ELASTOMERIC VULCANIZATES
Richard A. Faoro Mar. 1974 26 p refs
(AD-784068; RIA-R-TR-74-014) Avail: NTIS CSCL 11/10

A test method was developed for use in determining the hydrolytic stability of elastomeric vulcanizates. The test covers the determination of the tensile strength of elastomeric vulcanizates before and after exposure over water for four days at 185F. Results for some solid elastomers are reported. (Modified author abstract) GRA

N75-11106# Rock Island Arsenal Lab., Ill. General Thomas J. Rodman Lab.
ELASTIC RECOVERY TEST FOR ELASTOMERS
Edward W. Berstrom May 1974 34 p refs
(AD-784069; RIA-R-TR-74-029) Avail: NTIS CSCL 11/10

A fixture was designed and tested for use in measuring the elastic recovery of elastomeric vulcanizates at elevated temperatures in gaseous or liquid media. Elastic recovery was determined in air and in ASTM no. 3 oil at ambient and at elevated temperatures on vulcanizates based on high strength silicone, fluorosilicone and butadiene/acrylonitrile. Results showed that the compression set of the silicone vulcanizate in air was dependent on state of cure, test time and temperature, applied compression and amount of air circulation in the vicinity of the specimens. Elastic properties of the materials are discussed and compared. (Modified author abstract) GRA

N75-11107# Princeton Univ., N.J. Dept. of Chemical Engineering.
A SEMIMICRO THERMOMECHANICAL TECHNIQUE FOR CHARACTERIZING POLYMERIC MATERIALS: TORSIONAL BRAID ANALYSIS Technical Report, Dec. 1973 - Jul. 1974
John K. Gillham Aug. 1974 55 p refs
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-783102; TR-23) Avail: NTIS CSCL 11/9

An overview of a non-destructive semimicro mechanical technique which is used for characterizing phase transitions and transformations in polymeric materials is presented. Particular attention is given to literature published since January 1972, which pertains to advances in automation, data acquisition and processing, and application to polymeric systems. The instrument has been consolidated as a powerful and convenient mechanical spectrometer in this short period. (Modified author abstract) GRA

N75-11108# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DEGRADATION OF POLYMERS AT LOW TEMPERATURES BY NO2, O3 AND NEAR-UV RADIATION
H. H. G. Jellinek 25 Jun. 1974 30 p refs
(ARPA Order 1615)
(AD-782950; CRREL-RR-321) Avail: NTIS CSCL 11/9

A tensile strength, a static and a dynamic stiffness tester have been constructed for measuring appropriate mechanical properties of polymers as a function of temperature, environmental conditions (i.e. air plus NO2, O3 etc. or of the pollutants alone), exposure time and pollutant concentration. The dynamic stiffness tester is particularly sensitive to the onset of cracking in polymeric materials due to ozone. The tensile strength of linear polyurethane was affected appreciably by NO2 alone and also by NO2 in presence of air. Chain scission cross-linking, evolution of CO2 and other small molecular weight compounds, and formation of nitro and nitroso groups along the polymer backbone are reactions underlying the observed changes in mechanical properties of the polymer. A preliminary selection of polymeric skirting materials for SEV's (Surface Effect Vehicles) can be made on the basis of results obtained as functions of temperature. (Modified author abstract) GRA

N75-11109# Dayton Univ. Research Inst., Ohio. Research Inst.
LABORATORY TEST TECHNIQUES FOR EVALUATING THE THERMAL PROTECTION OF MATERIALS WHEN EXPOSED TO VARIOUS HEAT SOURCES
E. Dale Ernst Mar. 1974 34 p refs
(Contract F33615-72-C-1620; AF Proj. 7320)
(AD-784923; AFML-TR-74-118) Avail: NTIS CSCL 11/5

The report presents the laboratory test techniques used for evaluating the thermal protection characteristics of materials when exposed to a number of heat sources. The parameters of prime importance are athermancy and thermal shrinkage. The techniques described, combined with an off line data reduction package, provide a measure of materials thermal protection against human skin burns. Author (GRA)

N75-11039 Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
CRYSTAL GROWTH METHODS FOR THE PRODUCTION OF ALIGNED COMPOSITES
A. Hellawell *In* AGARD Specialists Meeting on Directionally Solidified In-Situ Composites Aug. 1974 p 57-66 refs (For availability see N75-11034 02-24)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N75-11110 National Bureau of Standards, Boulder, Colo. Cryogenic Data Center.
HYDROGEN FUTURE FUEL: A LITERATURE SURVEY ISSUED QUARTERLY, ISSUE NO. 6
Nov. 1974 31 p refs
Avail: Issuing Activity

A bibliography is presented of papers concerning energy and hydrogen fuel. Approximately 500 references are listed. F.O.S.

N75-11111*# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION CHEMISTRY OF SOLID PROPELLANTS Final Report
A. D. Baer and N. W. Ryan 15 Sep. 1974 71 p refs
(Grant NGL-45-003-019)
(NASA-CR-140821) Avail: NTIS HC $4.25 CSCL 21I

Several studies are described of the chemistry of solid propellant combustion which employed a fast-scanning optical spectrometer. Expanded abstracts are presented for four of the studies which were previously reported. One study of the ignition of composite propellants yielded data which suggested early ammonium perchlorate decomposition and reaction. The results of a study of the spatial distribution of molecular species in flames from uncatalyzed and copper or lead catalyzed double-based propellants support previously published conclusions concerning the site of action of these metal catalysts. A study of the ammonium-perchlorate-polymeric-fuel-binder reaction in thin films, made by use of infrared absorption spectrometry, yielded a characterization of a rapid condensed-phase reaction which is likely important during the ignition transient and the burning process. Author

N75-11112# Sandia Labs., Albuquerque, N.Mex.
THERMAL IGNITION OF PYROTECHNICS THROUGH A BULKHEAD
E. A. Kjeldgaard and D. J. Gould [1974] 14 p
(SLA-74-5094) Avail: NTIS HC $3.25

Thermal ignition of a pyrotechnic through a metal bulkhead under pressure has been accomplished by utilizing thin wall, small diameter tubing. The results from this investigation indicate that design of a reliable ignition system that will not leak under short term conditions of high pressure at elevated temperature is feasible. Author (NSA)

N75-11113# Michigan Univ., Ann Arbor. Gas Dynamics Labs.
MECHANISM IN THE DETONATION REGIME Final Report, 24 May - 31 Dec. 1973
J. A. Nicholls, T. H. Pierce, L. Dye, R. Fry, and K. Kearney Jun. 1974 180 p refs
(Contract DAAA21-73-C-0571)
(AD-784318; UM-012118-1-F) Avail: NTIS CSCL 07/4

A vertical detonation tube was used to study the blast initiated detonation of various liquid fuels (organic nitrates and nitro compounds), including some monopropellants, in a few different oxygen-nitrogen atmospheres. The fuels tested included n-propyl nitrate, nitropropane, nitromethane, and decane. All fuel drops were of the same size and a range of mixture ratios were tested. Attention was given to the influence of diaphragm thickness, ignition point location in the driver, and charge gas equivalence ratio in the driver. Experiments were also conducted in a sectored chamber, wherein cylindrical blast waves were generated by a condensed explosive and electric detonators. (Modified author abstract) GRA

N75-11114# Purdue Univ., Lafayette, Ind. Thermal Sciences and Propulsion Center.
STUDIES OF SLURRY FUELED PROPULSION SYSTEMS Semiannual Progress Report, 1 Feb. - 31 Jul. 1973
Bruce A. Reese and Harry M. Carbone Sep. 1973 50 p refs
(AD-784362; TSPC-TM-73-5; SAPR-7) Avail: NTIS CSCL 21/4

The results of the experimental investigation of the combustion efficiencies of selected fuels, JP-5, 75% Aluminum/25% Decalin, 30% Carbon/70% TH Dimer, Shelldyne, and Boron slurry, burned in sudden dump combustors are presented and discussed. Author (GRA)

N75-11115# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
LUBRICITY OF JET A-1 AND JP-4 FUELS Final Report
Joseph Petrarca, Jr. Jun. 1974 72 p refs
(AF Proj. 3048)
(AD-784772; AFAPL-TR-74-15) Avail: NTIS CSCL 21/4

This report describes the evaluation of an instrument that gives an indication of the lubricity of a fuel and of the results from testing Jet A-1 and JP-4 fuels with the device. The instrument is the Furey Ball-on-Cylinder. The preliminary investigation dealt with establishing the repeatability and reproducibility of the rig on pure hydrocarbons and Jet A-1 fuels. Also, the results from the Jet A-1 fuels served as the basis for a direct comparison between the wear scar diameter from the Ball-on-Cylinder and the coefficient of friction from the Bendix-CRC Lubricity Simulator. The Jet A-1 fuels which were composed of a high percentage of heavy end hydrocarbons had the best lubricity. In a similar manner, JP-4 fuels which contained corrosion inhibitors, were tested on the Ball-on-Cylinder and the wear scar diameters obtained were compared to the fuels properties. No correlations were found. (Modified author abstract) GRA

N75-11116# Lockheed Propulsion Co., Redlands, Calif.
COMBUSTION OF NITRAMINE PROPELLANTS Quarterly Progress Report
Norman S. Cohen 30 May 1974 25 p refs
(Contract F44620-74-C-0031; AF Proj. 9711)
(AD-783345; AFOSR-74-1202TR) Avail: NTIS CSCL 21/2

Nitramines are of interest in gun propellants to optimize impetus and flame temperature under constraints regarding smokelessness, flash, corrosion, compatibility, sensitivity, and cost. A comprehensive model of ammonium perchlorate composite propellant combustion was developed for the purpose of establishing combustion tailoring criteria. The model has been able to predict particle size effects and the limitations of particle size adjustment by direct combustion. Through parametric variation, it also has been possible to show the effect (and thereby the potential) of changing a given mechanism. This same approach is herein being applied to the understanding of nitramine propellant combustion. The essential task is to model the role of nitramines as distinguished from ammonium perchlorate. GRA

N75-11117# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
AGENDA AND ABSTRACTS 1974 AFOSR CONTRACTORS MEETING ON UNCONFINED DETONATION AND FUEL-AIR EXPLOSION RELATED RESEARCH Interim Report
Roger A. Strehlow Jun. 1974 46 p refs Conf. held at Eglin AFB, Fla., 13-14 Jun. 1974
(Grant AF-AFOSR-2524-73; AF Proj. 9711)
(AD-783253; AFOSR-74-1284TR) Avail: NTIS CSCL 19/1

The report consists of a collection of abstracts of the numerous research progress reports given by AFOSR contractors and of invited papers from other governmental agencies and CONUS and European contractors. These papers presented over a two-day period composed the 1974 annual contractors meeting on combustion dynamics associated with fuel-air explosion phenomena. The principal investigators and their organizational association are also identified. Author (GRA)

N75-11118# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
IGNITION AND FLAMMABILITY PROPERTIES OF FIRE-SAFE FUELS Interim Report
W. W. Wimer, B. R. Wright, and W. D. Weatherford, Jr. Feb. 1974 52 p refs
(Contract DAAK02-73-C-0221)

(AD-784281) Avail: NTIS CSCL 21/4

The report describes the results of efforts to conduct an ignition-limits study of halogenated hydrocarbons (halons), including the influence of bromochloromethane (BCM or halon 1011) on diesel fuel flammability limits, and to determine the flammability hazards as measured by mist flashback and impact dispersion procedures that were originally developed for assessment of aircraft-fuel crash survivability. Background information is provided to illustrate the nature of the experimental problem, and the method and apparatus designed for obtaining flammability limits is described. (Modified author abstract) GRA

N75-11119# Leeming (Harold) and Associates, Redlands, Calif.
DEVELOPMENT OF A THREE DIMENSIONAL STRESS GAGE FOR PROPELLANT GRAINS
Harold Leeming and W. Briggs Aug. 1974 54 p refs
(Contract F04611-72-C-0041)
(AD-784871; R-71-102-S; AFRPL-TR-74-19) Avail: NTIS CSCL 21/9

This report covers the preliminary investigations into the techniques for manufacturing, calibrating and testing devices for measuring the six stress components in a solid propellant grain. The basic design work led to two alternative but similar 3D gages which were built by Konigsberg Instruments and tested by HL and A. The results of these tests are described and recommendations made to AFRPL concerning the additional effort to be completed under the contract are given. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N75-11120*# Scientific Translation Service, Santa Barbara, Calif.
EXTRACTION OF IRON WITH METHYLETHYLKETONE
E. Gagliardi and H. P. Woess Washington NASA Nov. 1974 13 p refs Transl. into ENGLISH from Z. Anal. Chem. (East Germany), v. 248, 1969 p 302-304
(Contract NASw-2483)
(NASA-TT-F-16041) Avail: NTIS HC $3.25 CSCL 13H

The extraction of iron (III) with methylethylketone as solvent from hydrochloric acid solution is described, and the maximum range of acid concentration for quantitative extraction was determined. Most of the elements of the third analytical group were investigated for their extractibility with ketone, and the advantages of this compound are illustrated. Separation of iron from several other elements is possible. The separation from aluminum and manganese is described. Author

N75-11121# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
COST OF PRODUCING COPPER FROM CHALCOPYRITE CONCENTRATE AS RELATED TO SO2 EMISSION ABATEMENT: AN EVALUATION OF FIVE SMELTING PROCEDURES
Masami Hayashi, Henry Dolezal, and J. H. Bilbrey, Jr. 1974 94 p
(BM-RI-7957) Avail: NTIS HC $4.75

Cost evaluations were made for five processes for producing 100,000 tons of electrorefined copper per year from a chalcopyrite concentrate. The processes were: (1) conventional smelting with all furnace gases vented to the atmosphere; (2) conventional smelting with converter gases routed to an acid plant and reverberatory gases vented to the atmosphere; (3) conventional smelting with converter gases routed to an acid plant and reverberatory gases to a citrate system plant; (4) conventional smelting with all furnace gases routed to a citrate system plant; and (5) a modified smelting process in which the concentrate is roasted before being charged to the reverberatory furnace, with roaster and converter gases routed to an acid plant. Author

N75-11122# California Univ., Livermore. Lawrence Livermore Lab.
LIVERMORE PLAN: MANAGING THE INDUSTRIAL TRANSITION TO METRIC
J. W. Pearson 25 Feb. 1974 18 p Presented at the Am. Soc. for Testing and Mater. Symp., Washington, D. C., 24 Jun. 1974 Sponsored by AEC
(UCRL-75486; Conf-740601-1) Avail: NTIS HC $3.25

A changeover to the predominant use of the International System of Units is expected to be espcially beneficial to LLL because it will allow all the many scientific and engineering disciplines to talk to one another in the same measurement language. The problem of managing the transition has special difficulties, however, because of the large investment of fabricating and laboratory test equipment based on the inch or on non-SI metric units, and because the largely one-off nature of fabricating for research support and prototype design precludes such benefits available to high-volume production industries as special purpose tooling and go/no-go gaging that do not use measurement units. The development of the transition management plan has become known as the Livermore Plan. The Livermore Plan consists of seven fundamental ideas that are to be used to guide the different organizational activities in developing their operating rules, plans and schedules. NSA

N75-11123# Bendix Corp., Kansas City, Mo.
STATE-OF-THE-ART OF GENERAL DEBURRING METHODS
N. S. Ajlouny and L. K. Gillespie 1974 76 p refs Presented at SME International Tool and Mfg. Show Conf., Philadelphia, 29 Apr. 1974
(Contract AT(29-1)-613)
(BDX-613-1117; Conf-740445-1) Avail: NTIS HC $4.75

Burr removal is discussed as one of the most costly operation facing the manufacturers of mechanical components. Deburring methods are described, enumerating essentials of the operation, typical applications, capabilities and limitations. A schematic of each process is presented to illustrate the mechanics of deburring. Finally, two summary tables are presented that compare and evaluate the deburring techniques. Author

N75-11124# Bendix Corp., Kansas City, Mo.
PROFILE MILLING
L. K. Gillespie May 1974 61 p refs
(Contract AT(29-1)-613)
(BDX-613-980-Rev) Avail: NTIS HC $4.25

The end milling conditions which typically produce maximum edge straightness were identified. For 0.025 inch (0.635 mm) diameter cutters, a 0.010 inch (0.25 mm) radial depth of cut produces no net side thrust on the cutter, allowing single-pass profiling on nonferrous materials. Attempts to mill stainless steel with less than a full diameter cut have not been successful when using miniature end mills. Cam slots cut in brass tended to be 0.001 to 0.002 inch (0.026 to 0.051 mm) oversize with up to 0.001 inch wall runout. Cam slots cut into 303 Se stainless steel were up to 0.004 inch (0.1 mm) oversize with 0.001 inch wall runout. The deflection of miniature end mills at conditions other than zero side load can generally be predicted within 0.001 inch. Author

N75-11125# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
SOLDER FLUX RESIDUE CLEANING
K. E. Creed [1974] 18 p refs
(Contract AT(29-2)-656)
(GEPP-123) Avail: NTIS HC $3.25

When coil windings such as transformers and inductors are encapsulated in resin, care must be taken that good castings are achieved. Shear planes, voids, cracks, and delaminations in the casting provide structural weaknesses that may contribute to electrical breakdowns. Defect analysis of cast assemblies showed that the cracks, voids, and delaminations were often associated with solder flux residues. Solution of the problem was achieved by removal of the solder flux residue using ultrasonic cleaning in Freon-isopropanol prior to casting. However, because the wire enamel is soluble in the solvent, with subsequent deposition on the part, further investigation of enamel solubilities in a variety of solvents was carried out. Results showed that heptane offers the best compromise of low solubility, good resin removal and evaporation rate. Author (NSA)

N75-11126# Bendix Corp., Kansas City, Mo.
BURR: MANUFACTURING'S PERENNIAL THORN
L. K. Gillespie 1974 27 p refs Presented at the Soc. of Manufacturing Engr. Intern. Tool and Manufacturing Show Conf., Philadelphia, 29 Apr. 1974
(Contract AT(29-1)-613)
(BDX-613-1112; Conf-740445-2) Avail: NTIS HC $3.75

There are five approaches to minimizing deburring costs. Improvements in deburring processes represents the most common approach. The four approaches which are often overlooked include value analyzing product requirements, practicing burr prevention and minimization, and removing burrs during idle time. Examples of each approach are described. Author

N75-11127# Bendix Corp., Kansas City, Mo.
APPLICATION OF STATISTICAL METHODS TO MANUFACTURING OPERATIONS
C. Latimer and J. H. Carder Mar. 1974 38 p refs
(Contract AT(29-1)-613)
(BDX-613-1079) Avail: NTIS HC $3.75

A wide variety of statistical techniques have application to manufacturing operations. This paper describes the application of some of these techniques to a number of specific cases in a large multi-product manufacturing organization. The cases chosen involve plastic molding and functional testing. The statistical techniques used include analysis of variance, discriminant analysis, nonlinear regression, response surfaces, non-parametric statistics, bivariate normal distribution, and Grubbs' method for estimating components of variability. The emphasis is on relating the statistical techniques to the manufacturing situation under study. Author

N75-11128# Bendix Corp., Kansas City, Mo.
NONMETALLIC TOOLING CAPABILITIES AND ECONOMICS Final Report
R. W. Freund May 1974 15 p Revised
(Contract AT(29-1)-613)
(BDX-613-1065-Rev) Avail: NTIS HC $3.25

Nonmetallic materials are both useful and economical for many manufacturing tools and encapsulation molds. The RTV silicon-rubber molds cast from machined metal mold masters are capable of reproducing complex shapes and intricate detail. Microballoon-filled epoxy molds can maintain closer tolerances on the molded parts, but are prone to break when removing the parts from the molds. High-impact polycarbonate assembly fixtures provide all of the functions required for most cable-assembly operations at less cost and procurement time. Nonmetallic molds and fixtures are particularly attractive for prototypes and small-quantity manufacturing, but also are economical for many normal production applications. Nylon potting shells for rack-and-panel connectors provide potential cost savings over conventional metal molds. Author (NSA)

N75-11129# Hanford Engineering Development Lab., Richland, Wash.
SODIUM FIRE PROTECTION BY SPACE ISOLATION WITH INERT GAS FLOODING
R. K. Hilliard, P. E. McPherson, and J. M. Yatabe 1974 15 p ref Presented at Conf. on Fast Reactor Safety, Los Angeles, 2 Apr. 1974
(Contract AT(45-1)-2170)
(HEDL-SA-622; Conf-740401-5) Avail: NTIS HC $3.25

The concept of sodium fire protection by space isolation with inert gas flooding is described and the requirements for implementation in a LMFBR facility are pointed out. The mechanisms for oxygen inleakage are analyzed and the rate of inert gas injection required to prevent oxygen inleakage is calculated. A large-scale proof test was performed to demonstrate the method under actual fire conditions. The 770 lb sodium spill at 1100F into a full scale mockup of an FFTF secondary sodium pipeway was effectively controlled and extinguished. Comparisons are made with SOFIRE code predictions.
Author (NSA)

N75-11130# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
DIFFUSION PROCESS OF THE FORMATION OF MnBi FILMS PREPARED BY VACUUM EVAPORATION AND ANNEALING
A. Lutter 1974 10 p refs
(KFKI-74-14) Avail: AEC Depository Libraries HC $4.00

The formation rate is described of MnBi thin films by transmission measurements. The kinetical equation of the diffusion process was found in which the diffusion constant was the activation energy. The process is accomplished by diffusion of Mn atom through the defects of the formed MnBi phases. Author

N75-11131# Texas Instruments, Inc., Dallas. Central Research Labs.
LIQUID CRYSTAL DISPLAY PANEL Quarterly Technical Report, 1 Mar. - 31 May 1973
A. R. Kmetz Jul. 1974 27 p refs
(Contract DAAB07-72-C-0158)
(AD-782817; TI-08-73-41; ECOM-72-0158-4; QTR-4) Avail: NTIS CSCL 09/5

The objective of this program is to demonstrate the feasibility of developing an effective x-y addressed liquid crystal display by fabricating a three-inch square flat dynamic scattering device incorporating all addressing and drive circuitry for the display of alphanumeric and vector-graphical information at a resolution of 30 lines per inch. Photomask fabrication by reticle composition has been accomplished. Silicon slice processing is in progress. Calculations have been made that verify thermal expansion aspects of package design. GRA

N75-11132# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BORING OF CERTAIN HARD-TO-WORK MATERIALS IN THE PRESENCE OF TIN-ZINC EUTECTIC SOLUTION
E. D. Shchukin, G. G. Yashin, Yu. N. Talnov, K. M. Kachkaev, and Z. M. Polukarova 9 Aug. 1974 15 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 3, May-Jun. 1973 p 90-95
(AD-784265; FTD-HC-23-1679-74) Avail: NTIS CSCL 13/8

The influence of a eutectic fusion of tin and zinc on the process of drilling hard-to-work materials, steels, G-13, 45, R18F5K, and the alloy ZhS6K were investigated. It is demonstrated that the application of a tin-zinc eutectic solution as an active lubricating and cooling fluid leads to increased speed in drilling, to a great decrease in specific work of cutting, and to a significant decrease in wear on instruments. GRA

N75-11133# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILIZATION AND HOLDING OF METALS BY MAGNETIC FIELD
E. S. Paslavskii 1 Jul. 1974 21 p refs Transl. into ENGLISH from Raspredelennoe Upr. Protsessami v Sploshnykh Sredakh. Tr. Seminara (USSR), v. 1, no. 1, 1969 p 43-57
(AD-783572; FTD-HT-23-1289-74) Avail: NTIS CSCL 13/4

Most metals in a molten state have a high degree of chemical activity. The material of the crucible dissolves in the molten metal and contaminates it. Modern technology has often posed the problem of obtaining a metal which is of the same purity after melting as before. This problem becomes particularly acute when superpure and refractory materials are desired. A promising solution to this problem appears to be the use of an electromagnetic crucible. A device is described in which molten metal is held by the forces of the electromagnetic field and does not have direct contact with any substance. GRA

N75-11604 Joint Publications Research Service, Arlington, Va.
FEATURES IN THE DESIGNING OF PRESSURIZED UNDERWATER HABITATS AND PROSPECTS FOR THEIR UTILIZATION
V. N. Shabalin, A. B. Korolev, and V. B. Muravyev *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 72-84 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 66-78 (For availability see N75-11596 02-52)

N75-11606 Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR UTILIZATION OF UNDERWATER HOUSES AND CHAMBERS IN DEVELOPMENT OF MARINE OIL DEPOSITS
I. P. Kuliyev and Yu. P. Vladimirov *In its* Some Results and

Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 90-93 Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 83-86 (For availability see N75-11596 02-52)

N75-11608 Joint Publications Research Service, Arlington, Va.
UNDERWATER HOUSES IKHTIANDR-66 AND IKHTIANDR-67
Yu. M. Barats, A. G. Zubchenko, A. A. Ivanin, Yu. Yu. Kachuro, Yu. N. Kiklevich, V. I. Pesok, V. G. Rudenko, and G. A. Tunin *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 99-106 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 90-98 (For availability see N75-11596 02-52)

N75-11614 Joint Publications Research Service, Arlington, Va.
PRESSURIZED UNDERWATER HOUSES AND SHELTERS
A. B. Korolev, V. N. Shabalin, and V. B. Muravyev *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 143-150 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 134-142 (For availability see N75-11596 02-52)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N75-11134# Joint Publications Research Service, Arlington, Va.
REFLECTION OF STRONG RADIO WAVES FROM THE IONOSPHERE
A. B. Shvartsburg 30 Oct. 1974 8 p refs Transl. into ENGLISH From Dokl. Akad. Nauk SSSR (Moscow), v. 215, no. 4, 1974 p 825-828
(JPRS-63319) Avail: NTIS HC $3.25

The reflection of a narrow centered beam of radio waves from the ionosphere is studied. Author

N75-11135# Australian Post Office Research Labs., Melbourne.
TRANSMISSION RATES AND ERROR CONTROL IN HIGH SPEED DIGITAL COAXIAL SYSTEMS
N. Q. Duc Dec. 1973 34 p refs
(Rept-6834) Avail: NTIS HC $3.75

A comparison of transmission rates was carried out for high-speed digital coaxial systems using three-level and five-level line signals. The five-level scheme (6B-3QI) shows a reduction of 15% to 20% in line rate over the three-level plan (4B-3T) while the corresponding input bit rates are approximately increased by 20% to 30% for repeater spans of 1.5 km and 4.5 km. The possibility was also investigated of increasing the transmission rates by the use of error-correcting codes. For a given set of parameters (e.g. peak signal power, repeater span, error rate, and type of line code), the application of such techniques was found to yield little gain in effective bit rate. Error control is instead suggested as a useful measure of maintaining the system efficiency against possible adverse operating conditions. Author

N75-11136*# Axiomatix, Marina del Rey, Calif.
INTEGRATED SOURCE AND CHANNEL ENCODED DIGITAL COMMUNICATION SYSTEM DESIGN STUDY Final Report
Gaylord K. Huth and Sergei Udalov 4 Oct. 1974 65 p refs
(Contract NAS9-13467)
(NASA-CR-140329; R7410-4) Avail: NTIS HC $4.25 CSCL 17B

This study investigated the configuration and integration of a wideband communication system with a Ku-band rendezvous radar system. The goal of the study was to provide as much commonality between the two systems as possible. The antenna design was described with the only change being the requirement for dual polarization (linear for the radar system and circular for the communication system). M.C.F.

N75-11137# Oak Ridge National Lab., Tenn.
TRANSIENT RESPONSE OF LOW FREQUENCY VERTICAL ANTENNAS TO HIGH ALTITUDE NUCLEAR ELECTROMAGNETIC PULSE (EMP)
P. R. Barnes and D. B. Nelson Jun. 1974 43 p refs
(ORNL-4960) Avail: NTIS HC $3.75

Several antenna models are used to calculate the transient response of top-loaded LF vertical antennas to electromagnetic pulse (EMP) from high altitude nuclear detonations. Examples are given of the short circuit current and voltage across an idealized load for a 360 meter high, top-loaded antenna illuminated by two representative EMP fields. Good agreement is obtained among all the models used. The effect of the angle of incidence theta is quite pronounced. The early time current and voltage at 30 is almost twice what it is at 90, confirming the 1/sin theta behavior. On the other hand, end effects occur sooner at 30, reducing the low frequency content. Thus the late time behavior is largest at 90. In general it will be true for long antennas that effects depending on initial rate of rise will be maximized for small theta, whereas effects that depend on total surge energy are maximized for broadside incidence. Author (NSA)

N75-11138# Sandia Labs., Albuquerque, N.Mex. Applied Mathematics Div.
EFFECT OF PHASE NOISE ON THE REAL-TIME ZERO-CROSSING MEASUREMENT OF FREQUENCY
E. A. Aronson Apr. 1974 17 p refs
(Contract AT(29-1)-789)
(SLA-74-100) Avail: NTIS HC $3.25

This report derives an expression for the statistics of the errors in the real time zero crossing measurement of the frequency of a sinusoid that is corrupted by phase noise and additive noise whose power is much less than the signal power. A specific expression is shown for the case where the phase noise and additive noise are independent, stationary, Gaussian processes. Numerical results are given for some interesting cases. Application of the results to a Doppler difference measurement system is also presented. NSA

N75-11139# Defence Research Establishment Ottawa (Ontario).
A STUDY OF THE CAPABILITY OF GRAMMATICAL ANALYSIS TO IMPROVE ACCURACY IN CONTINUOUS SPEECH RECOGNITION FOR COMMAND AND CONTROL Final Report
William B. Newcomb, Wilbur D. Larkin, and Robert A. Houde 28 Jun. 1974 164 p refs
(Contract F44620-71-C-0090; AF Proj. 9769)
(AD-784835; AFOSR-74-1361TR) Avail: NTIS CSCL 17/2

The program is directed toward the development of a theory of speech understanding systems which explicates the role to be played by linguistic constraints (syntax and semantics) in correcting the errors resulting from word recognition at the acoustic-phonetic-lexical level alone. The general model of a speech understanding system which provides the framework for this study is that which views speech understanding as basically an acoustic-phonetic word recognition process, whose decisions are questioned, and sometimes overruled, by criteria at the syntactic and semantic levels. The principal components of this model are (1) an acoustic to phonetic transformation, (2) a lexical process (the lexical process along with the acoustic to phonetic transformation constitute the basic word recognition system whose output is judged by higher level linguistic constraints), (3) a model of standard English syntax, (4) a model of standard English semantics, and (5) an integrating process which determines the strategies to be used in backtracking over previous decisions. (Modified author abstract) GRA

N75-11140# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPACT ACOUSTIC SURFACE WAVE FREQUENCY MULTIPLEXERS
Kenneth R. Laker, A. J. Budreau, and P. H. Carr 29 Jul. 1974

8 p refs Presented at the Conf. of 1974 IEEE Intern. Symp. on Circuits and Systems, Apr. 1974 p 401-403
(AF Proj. 5635)
(AD-783654; AFCRL-TR-74-0336) Avail: NTIS CSCL 17/2

The design of low cost, compact surface acoustic wave frequency multiplexers is described. The frequency selective properties of surface wave filters are used to achieve low inband (high-Q) loss and high outband rejection. Observations made on measured transducer input impedances are used to affect a simple insertion loss minimization technique applicable to N coupled surface wave filters. Author (GRA)

N75-11141# North Carolina Univ., Chapel Hill. Dept. of Statistics.
THE EFFECT OF SAMPLING JITTER ON SIGNAL DETECTION BY AN ARRAY
Charles R. Baker and Louis R. Chow 6 May 1974 43 p refs
(Contract N00014-67-A-0321-0006; Grant
AF-AFOSR-2386-72; NR Proj. 042-269)
(AD-784346; B-74-1) Avail: NTIS CSCL 09/4

The effect of random errors (jitter) in sampling times is analyzed for an array processor, the Bryn processor. Expressions for array gain as a function of sampling error are obtained. Numerical results are presented that indicate a substantial loss in array gain can occur under some conditions. (Modified author abstract) GRA

N75-11142# Office of the Director of Defense Research and Engineering, Washington, D.C.
T AND E GUIDELINES ASW SYSTEMS
2 Apr. 1974 40 p
(AD-784399) Avail: NTIS CSCL 15/1

Contents: Conceptual phase; validation phase; full-scale engineering development phase; and substantial production/deployment phase. GRA

N75-11143# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF PASSIVE HORN ANTENNA FOR THE AIRPORT SURVEILLANCE RADAR-5 Final Report
Dominick L. Offi Jul. 1974 47 p
(FAA Proj. 022-241-010)
(AD-783748; FAA-NA-74-12) Avail: NTIS CSCL 17/9

A passive horn modification kit was developed by the Raytheon Company for the National Aviation Facilities Experimental Center, Airport Surveillance Radar-5 test bed. The modified system was evaluated to determine the extent of performance improvements realized and to assess its applicability to all airport surveillance radars. System tests indicated the modification had no deleterious effect on the normal, low-beam coverage, and provided an improvement in signal-to-clutter ratio when small aircraft were competing with various forms of clutter. It was recommended that a passive horn modification providing dual-beam capability for all airport surveillance radars be considered for field implementation. Author (GRA)

N75-11144# Naval Electronics Lab. Center, San Diego, Calif.
SHIP RFI SURVEY PROCEDURE FOR HF FREQUENCIES: A TASK UNDER THE SHIPBOARD EMC IMPROVEMENT PROGRAM (SEMCIP)
W. M. Chase 21 Jun. 1974 86 p
(AD-784368; NELC-TD-336) Avail: NTIS CSCL 20/14

The document provides a method of obtaining the most meaningful information possible regarding the potential RFI situation on a ship from data taken under severe time restrictions. Discussion is limited to the HF band, 2-30 MHz, but similar tests conducted at other frequencies will provide results of equal merit. Since the effect of RFI on reception capability, rather than the phenomena causing it, is being investigated, the ship's receiving subsystem is used to monitor RFI signals with a minimum of special equipment. The fundamental question is, How great is the potential for RFI due to intermodulation interference signals on this specific ship. It is chiefly asked (1) during sea trials of new construction, (2) prior to a scheduled shipyard availability for an operational ship, and (3) just after work in a shipyard has been completed. The method does not simulate operational conditions by activating a majority of the available transmitters simultaneously. By monitoring individual interference signal levels when only two transmitters are operating, it provides accurate predictions of the severity of operational interference conditions. If RFI potential is high, the most important source can be determined. If several sources are found, they are automatically ranked in order of importance. Author (GRA)

N75-11145# Office of the Director of Defense Research and Engineering, Washington, D.C.
T AND E GUIDELINES FOR AIRBORNE GENERAL SURVEILLANCE RADAR SYSTEMS
2 Apr. 1974 27 p
(AD-784400) Avail: NTIS CSCL 17/9

The checklist items presented are specifically applicable to airborne general surveillance radar testing and evaluation. The checklists cover various aspects of the major activities that should be underway during a given time period. GRA

N75-11146# Naval Postgraduate School, Monterey, Calif.
UNIQUE WORDS FOR IDENTIFICATION AND SYNCHRONIZATION IN TDMA SATELLITE COMMUNICATION SYSTEMS M.S. Thesis
Philip Myron Sanborn Jun. 1974 81 p refs
(AD-784762) Avail: NTIS CSCL 17/2

In a time-division multiple-access (TDMA) system, many transmitting stations time-share the same RF spectrum. Individual transmissions must be identifiable to distant receiving stations and must be synchronized so that no interference overlap occurs. A unique word sequence can serve both purposes. The basic concepts of a satellite communications TDMA system are briefly reviewed, with emphasis on functional receiver requirements. A correlation detection scheme is hypothesized, from which false and miss-detection probability expressions are derived. Criteria are then established for the selection of sequences suitable for use as unique words. Representative unique words of length 15 through 20 are included, along with an explanation of the difficulties encountered in devising an efficient computer search routine. Author (GRA)

N75-11147# Aerospace Corp., El Segundo, Calif. Lab. Operations.
NASC-117 SATELLITE EXPERIMENT: MEASUREMENT OF THE NONLINEAR IMPEDANCE AND NONLINEAR PLASMA EFFECTS IN THE NEAR FIELD OF AN ELECTRIC-DIPOLE ANTENNA Final Report
Harry C. Koons, Frederick A. Morse, and Donald A. McPherson
31 Jul. 1974 117 p refs
(Contract F04701-74-C-0075)
(AD-784834; TR-0075(9260-09)-1; SAMSO-TR-74-162) Avail: NTIS CSCL 09/5

The nonlinear impedance of a satellite-borne, electric-dipole antenna was measured at ELF/VLF at drive voltages between 10 mV and 100 V peak-to-peak. The magnitude of the impedance is in general agreement with the predictions of theoretical models of plasma-clad antennas. At the higher drive voltages the magnitude of the impedance is a weak function of electron density. The magnitude decreases as electron density increases. At low voltages the phase angle of the impedance is in agreement with linear sheath models. As the voltage increases the phase angle rotates through 0 deg in the inductive sense. Above 10 V p-p the phase angle often exceeds -90 deg. The electric and magnetic field intensities measured in the near field of the primary dipole are presented as a function of frequency, drive voltage, and electron density. Author (GRA)

N75-11148# Philco-Ford Corp., Willow Grove, Pa. Communications Systems Div.
AUTOMATIC INTELLIGIBILITY TEST EQUIPMENT Final Report, 4 Apr. 1972 - 15 Sep. 1973
Donald J. Jurenko Mar. 1974 88 p refs
(Contract F30602-72-C-0321)
(AD-784853; RADC-TR-74-51) Avail: NTIS CSCL 17/2

The report describes an Automatic Intelligibility Test equipment (AITE) which automatically measures the word intelligibility of a digital voice communication link. The system consists of a Nova 820 mini computer, A/D converter, teletype unit (ASR-33), tape recorder, high speed paper tape reader and punch set, and the phoneme test sequence. The phoneme test sequence is

recorded on audio tape which played through the equipment being evaluated and then into the AITE. A set of forty phoneme correlation masks were designed using phoneme pattern matching in conjunction with listening jury statistics. The AITE evaluates the phoneme test sequence using speech correlation techniques to determine the word intelligibility. Author (GRA)

N75-11149# Aerospace Corp., El Segundo, Calif.
MICROWAVE BREAKDOWN ON THE RANT FLIGHT ANTENNAS: PREFLIGHT TESTS Interim Report
Glenn C. Light 8 Aug. 1974 32 p refs
(Contract F04701-74-C-0075)
(AD-784826; TR-0075(5450-62)-1; SAMSO-TR-74-185) Avail: NTIS CSCL 09/5

The report summarizes all of the laboratory breakdown data obtained by the contractor with the RANT S-band and VHF flight antennas. Comparisons are made between the observed and expected values of breakdown power for the observed values of pulse duration to breakdown for all of the data. The calculations were done using the Aerospace breakdown code (BRKDN4) for pulsed breakdown in uniform air in a nonuniform electric field. It was concluded that values of power incident on the antennas are in better agreement with values deduced from preassembly individual component tests than with those from the incident-power measurement system incorporated in the assembled vehicle. It was further concluded that best agreement between predicted and observed breakdown power is obtained if it is assumed that the antenna efficiencies are 0.49 for VHF and 0.68 for S-band. Author (GRA)

N75-10991* Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF THE DESIGN OF LOW-NOISE INPUT DEVICES
V. M. Manokhin, Yu. A. Nemlikher, I. A. Strukov, and Ye. A. Sharfov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 28-35 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 19-23 (For availability see N75-10988 02-18)
CSCL 17B

N75-10994* Kanner (Leo) Associates, Redwood City, Calif.
METHODS OF RADAR STUDIES OF THE MOON AND THE PLANETS FROM SPACECRAFT
N. N. Krupenio *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p-48-64 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow Nauka Press, 1972 p 31-42 (For availability see N75-10988 02-18)
CSCL 17I

N75-10997* Kanner (Leo) Associates, Redwood City, Calif.
THE EFFECTIVENESS OF CORRECTING CODES IN RECEPTION IN THE WHOLE IN ADDITIVE NORMAL WHITE NOISE
Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 97-106 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 64-69 (For availability see N75-10988 02-18)
CSCL 17B

N75-10998* Kanner (Leo) Associates, Redwood City, Calif.
SELECTION OF AN OPTIMAL PLAN FOR CONSTRUCTION OF A SPACECRAFT ANTENNA SYSTEM
B. A. Prigoda, M. B. Faynshteyn, V. A. Guryev, and A. S. Markin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 107-119 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 169-177 (For availability see N75-10988 02-18)
CSCL 09E

N75-11001* Kanner (Leo) Associates, Redwood City, Calif.
CIRCULARLY POLARIZED ANTENNAS WITH CONTROLLED RADIATION PATTERNS
B. A. Prigoda, V. A. Guryev, N. S. Ulyanin, and N. N. Kalugin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 163-167 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 109-112 (For availability see N75-10988 02-18)
CSCL 09E

N75-11008* Kanner (Leo) Associates, Redwood City, Calif.
COMMUNICATIONS BY LIGHT WITH LONG-RANGE SPACECRAFT
M. Z. Novikov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 246-263 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 161-172 (For availability see N75-10988 02-18)
CSCL 17B

N75-11258* Bendix Field Engineering Corp., Greenbelt, Md.
TRACKING THE LUNAR ROVER VEHICLE WITH VERY LONG BASELINE INTERFEROMETRY TECHNIQUES
Daniel Shnidman *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 90-99 refs (For availability see N75-11249 02-35)
CSCL 17B

N75-11264* National Communications System, Arlington, Va.
TIME AND FREQUENCY FOR DIGITAL TELECOMMUNICATIONS
Harold C. Folts *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 194-202 refs (For availability see N75-11249 02-35)
CSCL 17B

N75-11266* Naval Research Lab., Washington, D.C.
UTILIZATION OF FSK COMMUNICATIONS FOR TIME
Robert R. Stone, Jr., Thomas H. Gattis, and Theodore N. Lieberman (Naval Electron. Systems Command) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 213-224 (For availability see N75-11249 02-35)
CSCL 17B

N75-11267* Naval Electronic Systems Command, Washington, D.C.
TIMING REQUIREMENTS FOR THE SANGUINE ELF COMMUNICATIONS SYSTEM
Bodo Kruger *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 225-231 refs (For availability see N75-11249 02-35)
CSCL 17B

N75-11268* Naval Electronics Lab. Center, San Diego, Calif.
CALIBRATED VLF PHASE MEASUREMENTS: SIMULTANEOUS REMOTE AND LOCAL MEASUREMENTS OF 10.2kHz CARRIER PHASE USING CESIUM STANDARDS
Eric R. Swanson, Richard H. Gimber, and James E. Britt *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 232-248 ref (For availability see N75-11249 02-35)
CSCL 17B

N75-11269* National Bureau of Standards, Washington, D.C.
THE USES AND LIMITATIONS OF HF STANDARD BROADCASTS FOR TIME AND FREQUENCY COMPARISON
John T. Stanley *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1974 p 249-258 refs (For availability see N75-11249 02-35)
CSCL 17B

N75-11271* Corps of Engineers, Fort Belvoir, Va.
DELAY TIME MEASUREMENTS OF THE PROPAGATION OF RADIO WAVES IN THE ATMOSPHERE
Frederick Rohde *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 285-309 (For availability see N75-11249 02-35)
CSCL 20N

N75-11273* Army Electronics Technology and Devices Lab., Fort Monmouth, N.J.
INTERPRETATION OF VLF PHASE DATA
Friedrich Reder, James Hargrave, and James Crouchley (Queensland Univ.) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 324-344 refs (For availability see N75-11249 02-35)
CSCL 20N

N75-11297* Polytechnic Inst. of New York.
THE CORRELATION OF VLF PROPAGATION VARIATIONS WITH ATMOSPHERIC PLANETARY-SCALE WAVES
D. J. Cavalieri, R. J. Deland, Thomas A. Potemra (APL), and R. F. Gavin (APL) *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 397-426 refs (For availability see N75-11275 02-35)
CSCL 17B

N75-11298* Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC EFFECTS ON ONE-WAY TIMING SIGNALS
H. Soicher and F. J. Gorman, Jr. *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 427-441 refs (For availability see N75-11275 02-35)
CSCL 17B

N75-11302* Defense Communications Agency, Washington, D.C.
A TIME REFERENCE DISTRIBUTION CONCEPT FOR A TIME DIVISION COMMUNICATION NETWORK
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 505-527 refs (For availability see N75-11275 02-35)
CSCL 17B

N75-11303* Defense Communications Agency, Washington, D.C.
FUTURE DCS OBJECTIVES IN COMMUNICATION NETWORK TIMING AND SYNCHRONIZATION
Joseph R. Mensch *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 529-541 (For availability see N75-11275 02-35)
CSCL 17B

N75-11797 Joint Publications Research Service, Arlington, Va.
RESISTANCE OF RADAR SYSTEMS AGAINST INTERFERENCE
Khristo Popov *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 1-7 Transl. into ENGLISH from Voenna Tekhnika (Sofia), no. 8, 1974 p 26-28 (For availability see N75-11796 02-81)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N75-11150 Izdatelstvo Tekhnika, Kiev (USSR).
AUTOMATION DEVICES FOR THYRISTORS [USTROYSTVA AVTOMATIKI NA TIRISTORAKH]
V. A. Skarzhepa and A. A. Morozov 1974 226 p refs In RUSSIAN
Copyright. Avail: Issuing Activity

Principles of constructing modern automation devices for thyristors are considered and the preferred schematics are indicated. Single-operation, symmetric, and cut-off thyristors are described in detail. The logic circuits for alternating and direct current are presented, as well as scaling circuits with and without reverse scaler, keys for direct and alternating current, and other functional elements. Circuits are presented for constant-voltage stabilizers, position and continuous temperature regulators, and control circuits for thyristors in these devices. Author

N75-11151*# Arizona Univ., Tucson. Optical Sciences Center.
ELECTROMAGNETIC DIFFRACTION EFFICIENCIES FOR PLANE REFLECTION DIFFRACTION GRATINGS Final Report
A. S. Marathay and T. E. Shrode Sep. 1974 10 p refs
(Contract NAS5-11456)
(NASA-CR-139148) Avail: NTIS HC $3.25 CSCL 09C

The theory and computer programs, based on electromagnetic theory, for the analysis and design of echelle gratings were developed. The gratings are designed for instruments that operate in the ultraviolet portion of the spectrum. The theory was developed so that the resulting computer programs will be able to analyze deep (up to 30 wavelengths) gratings by including as many as 100 real or homogeneous diffraction orders. The program calculates the complex amplitude coefficient for each of the diffracted orders. A check on the numerical method used to solve the integral equations is provided by a conservation of energy calculation. Author

N75-11152*# Avco-Everett Research Lab., Everett, Mass.
EXPERIMENTAL INVESTIGATION OF ELECTRON CLOUD CONTAINMENT IN A NONUNIFORM MAGNETIC FIELD
J. E. Eninger May 1974 43 p refs
(Contract NAS8-24140)
(NASA-CR-120521; RR-400) Avail: NTIS HC $3.75 CSCL 09C

Dense clouds of electrons were generated and studied in an axisymmetric, nonuniform magnetic field created by a short solenoid. The operation of the experiment was similar to that of a low-pressure (approximately 0.000001 Torr) magnetron discharge. Discharge current characteristics are presented as a function of pressure, magnetic field strength, voltage, and cathode end-plate location. The rotation of the electron cloud is determined from the frequency of diocotron waves. In the space charge saturated regime of operation, the cloud is found to rotate as a solid body with frequency close to V sub a/phi sub a where V sub a is the anode voltage and phi suba is the total magnetic flux. This result indicates that, in regions where electrons are present, the magnetic field lines are electrostatic equipotentials (E bar , B bar = 0). Equilibrium electron density distributions suggested by this conditions are integrated with respect to total ionizing power and are found consistent with measured discharge currents. Author

N75-11153*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TESTING OF FLAT CONDUCTOR CABLE TO UNDERWRITERS LABORATORY STANDARDS UL719 AND UL83
Robert W. Loggins and Ralph H. Herndon Sep. 1974 28 p
(NASA-TM-X-64893) Avail: NTIS HC $3.75 CSCL 09A

The flat conductor cable (FCC) which was tested consisted of three AWG No. 12 flat copper conductors laminated between two films of polyethylene terephthalate (Mylar) insulation with a self-extinguishing polyester adhesive. Results of the tests conducted on this cable, according to specifications, warrants the use of this FCC for electrical interconnections in a surface nonmetallic protective covering. Author

N75-11154# Royal Aircraft Establishment, Farnborough (England).
NUMBER OF BARS AND TORQUE OF SQUIRREL CAGE ROTORS
W. Stiel Jun. 1974 22 p refs Transl. into ENGLISH from Z. Vereines Deutsch. Ing., v. 65, no. 6, 19212 p 147-152
(RAE-Lib-Trans-1781; BR42315) Avail: NTIS HC $3.25

Investigations on an asynchronous ac motor with eleven squirrel cage rotors with various numbers of bars are described. Torque curves were obtained using a spring dynamometer. Evaluation of the research data shows that the number of rotor slots must be smaller than that of the stator slots, must differ as little as possible from the latter, must be divisible by the number of poles, and must be an even number; the differences 1, 3, 5 ... in the number of bars are to be avoided. Author

N75-11155*# General Electric Co., Philadelphia, Pa. Space Div.

MODELING AND ANALYSIS OF POWER PROCESSING SYSTEMS

K. A. Fegley, J. H. Hayden, and D. W. Rehmann 28 Oct. 1974 365 p refs

(Contract NAS3-17783)

(NASA-CR-134714; IP80-5G4-170) Avail: NTIS HC $10.00 CSCL 09C

The feasibility of formulating a methodology for the modeling and analysis of aerospace electrical power processing systems is investigated. It is shown that a digital computer may be used in an interactive mode for the design, modeling, analysis, and comparison of power processing systems. Author

N75-11156# Sandia Labs., Albuquerque, N.Mex.

OPERATION AND RADIATION HARDNESS OF FULLY DECODED 16 X 16 MNOS-REPROM INTEGRATED CIRCUIT

R. Lodi (Sperry Rand Res. Center) and W. Dodson 1974 11 p refs Presented at Govt. Microcircuit Appl. Conf., Boulder, Colo., 25 Jun. 1974 Sponsored by AEC

(SLA-73-7053; Conf-740612-2) Avail: NTIS HC $3.25

The operation and performance characteristics of a fully decoded radiation hardened 256-bit MNOS REPROM integrated circuit are described. Experimental data obtained after exposing the circuit to 106 rads total dose are presented in conjunction with analysis which predicts the circuit behavior from the characteristics of the individual transistors used with the circuit. Author (NSA)

N75-11157# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTER MODELS FOR ANTENNAS

E. K. Miller 21 Jan. 1974 32 p refs

(Contract W-7405-eng-48)

(UCRL-51515) Avail: NTIS HC $3.75

An overview of wire-antenna computer modeling is given, with emphasis on the interface problem. The formulation and numerical-solution methods are summarized, and applications are demonstrated with numerous examples. Author (NSA)

N75-11158# Bendix Corp., Kansas City, Mo.

BEAM LEAD DEVICE AND HYBRID MICROCIRCUIT TESTING

R. E. Markley [1974] 38 p Presented at Product Testing Technol. and Automation Seminar, Kansas City, Mo., 28 Mar. 1974

(Contract AT(29-1)-613)

(BDX-613-1113; Conf-740325-1) Avail: NTIS HC $3.75

Testing of hybrid microcircuit components are reported. It is shown that they fall into two physical categories: semiconductor or beam lead device chips; and packaged metal oxide semiconductor large scale integration circuits. Levels of automatic testing processes have been developed and are reported operational. M.C.F.

N75-11159# California Univ., Livermore. Lawrence Livermore Lab.

TRANSIENT CHARACTERISTICS OF THE CONICAL SPIRAL ANTENNA

J. A. Landt and E. K. Miller 11 Mar. 1974 114 p refs

(Contract W-7405-eng-48)

(UCID-16461) Avail: NTIS HC $5.25

The short-pulse characteristics of the conical spiral antenna are examined in detail. The antenna is analyzed using a time-domain integral equation. Various peculiarities associated with the numerical solution procedure are discussed including the effects of high Q, low-frequency resonance, and impedance loading of the antenna. Special attention is directed to the radiated-pulse properties of the antenna for various types of time-varying excitation. A quantitative assessment of the antenna's fidelity under pulsed conditions is presented along with an approach to obtaining the desired radiated-pulse shape by tailoring the time variation of the applied antenna voltage. Author

N75-11160# Bendix Corp., Kansas City, Mo.

CHARACTERIZATION OF A CHROMIUM-GOLD DEPOSITION PROCESS FOR THE PRODUCTION OF THIN FILM HYBRID MICROCIRCUITS

F. A. Clay and R. W. Pierce May 1974 19 p refs Presented at Electron. Components Conf., Washington, D. C., May 1974

(Contract AT(29-1)-613)

(BDX-613-1109; Conf-740503-2) Avail: NTIS HC $3.25

A study was made of adhesion, electrical resistivity, and thermo compression bondability of chrominum-gold films which were deposited on tantalum nitride-coated aluminum oxide substrates. The results indicate substrate temperature must be controlled to within 300 + or - 10 C, chromium deposition rate must be controlled to within 1 to 3 angstroms/second, and gold deposition rate must be controlled to within 20 to 30 angstroms/second to obtain adequate resistivity and thermo-compression bondability. Author

N75-11161# California Univ., Livermore. Lawrence Livermore Lab.

NEW RARE EARTH QUANTUM ELECTRONIC DEVICES: A CALCULATIONAL APPROACH

W. F. Krupke Apr. 1974 43 p refs Presented at the IEEE Region 6 Conf., Albuquerque, N. Mex., 24 - 26 Apr. 1974 Sponsored by AEC

(UCRL-75476; Conf-740404-2) Avail: NTIS HC $3.75

The phenomenological models of radiative and nonradiative transition probabilities in rare earth doped solids are reviewed and the present phenomenological data base is summarized. A general computational methodology for the prediction of new laser and quantum electronic devices is outlined. Specific examples of CW and radiation switched lasers are given to illustrated the technique and to identify gaps in the data base. Author (NSA)

N75-11162# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).

POSSIBILITY OF THE SIMULATION OF A SLOW-WAVE SYSTEM BY A PHASED ARRAY OF WAVEGUIDES

M. Tutter and S. Puri Feb. 1974 12 p refs

(IPP-IV-66) Avail: AEC Depository Libraries HC $4.00

From general considerations it is shown that neither a flush mounted waveguide nor a phased array of waveguides is capable of simulating a transverse-magnetic slow-wave structure. Their superficial resemblance to slow-wave systems is traced to the paradox of Mach's Wave Machine. Author (NSA)

N75-11163# RAND Corp., Santa Monica, Calif.

AN ELECTROMAGNETIC COMPATIBILITY PROGRAM FOR THE 1970S (SELECTED ISSUES) Interim Report

A. L. Hiebert and S. A. Scharff Aug. 1974 294 p refs

(Contract F44620-73-C-0011)

(AD-784939; R-1114/1-PR) Avail: NTIS CSCL 09/3

To assess electromagnetic compatibility (EMC) problems created by increased dependence on and expanded use of communications-electronics systems, this study examines frequency application requirements, specifications, weapons systems acquisition procedures, and Air Force and industry practices. It also analyzes radio spectrum usage in terms of our capabilities for handling current spectrum utilization and future problems. Emphasis is on the technological aspects of EMC as applied to intrasystem and intersystem compatibility. A promising new technical concept is developed: the application of computers and mathematical models to intrasystem EMC technology and management, including vulnerability assessment, design of specifications, and control process. (Modified author abstract) GRA

N75-11164# Texas Instruments, Inc., Dallas. Semiconductor Group.

PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED POWER SWITCH (IPS) Quarterly Report, 18 Jan. - 17 Apr. 1974

Bill H. Terrell and L. Wayne Gordon Aug. 1974 63 p

(Contract DAAB05-73-C-2063)

(AD-783439; TI-03-74-24; QR-4) Avail: NTIS CSCL 09/5

The fourth quarterly report includes a general technical description and a discussion of potential uses for the Integrated Power Switch (IPS). No major technical problems were encoun-

tered and the program is on schedule. (Modified author abstract) GRA

N75-11165# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
HARDENED HYBRID SEMICONDUCTOR PACKAGES Final Report, 28 Jun. - 31 Dec. 1973
Frank A. Lindberg May 1974 81 p
(Contract DAAG39-73-C-0216; HDL Proj. 373433)
(AD-783432; HDL-TR-216-1; Rept 74-0303A) Avail: NTIS CSCL 09/5

The work was performed to develop a radiation hardened packaging technique for connecting integrated circuit chips. The interconnecting metal was chosen to be vapor deposited aluminum. The two layer substrate upon which the chips were mounted had beam leads integral with the metallization on the substrate. The two aluminum layers and the aluminum oxide dielectric layer were deposited in sequence through masks in a single vacuum chamber pumpdown. Author (GRA)

N75-11166# Army Foreign Science and Technology Center, Charlottesville, Va.
THE THEORY OF SYNTHESIS OF ANTENNA ARRAYS
M. B. Zakson and B. A. Kashin Aug. 1974 10 p refs Transl. into ENGLISH from Antenny (USSR), no. 3, 1968 p 30-38
(AD-784381; FSTC-HT-23-553-73) Avail: NTIS CSCL 09/5

The article examines certain possibilities of methods of synthesis of antenna arrays using the representation of a radiated electro-magnetic field in the form of superposition of electric and magnetic waves. GRA

N75-11167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF ELECTROMAGNETIC PROCESSES OF THYRISTOR PULSED-WIDTH CONVERTERS
V. V. Andrushchuk 11 Jul. 1974 16 p refs Transl. into ENGLISH from Elektrichestvo (USSR), no. 2, Feb. 1973 p 36-39
(FTD Proj. T74-04-03)
(AD-783991; FTD-HT-23-1150-74) Avail: NTIS CSCL 09/5

It is recommended that thyristor pulse-width converters with the inductive coupling be used in the systems of automatic control as the regulators of power. Such a converter makes it possible to obtain high switching frequencies with large values of the power source output coefficient; moreover, when analyzing the electromagnetic processes in the systems of thyristor pulse-width converters it is advisable to use a computer which permits one to study the processes over a wide range of change in the parameters with consideration of the nonlinearity of the element characteristics. GRA

N75-11168# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A VOLTAGE CONTROLLED OSCILLATOR/MIXER Final Report, 1 Jan. - 31 Dec. 1974
Marion C. Bartlett and Raymond C. Johnson Aug. 1974 16 p refs
(Contract DAAG39-74-C-0039; HDL Proj. A22400; HDL Proj. 101400)
(AD-784628; HDL-039-2) Avail: NTIS CSCL 09/5

A new technique for product mixing of an input signal with a locally generated reference by using a voltage controlled oscillator (VCO) is described and verified both mathematically and experimentally. The technique consists of frequency modulating the oscillator with the signal voltage. It is shown that for low-index frequency modulation by the signal, the sidebands of the oscillator produced by the signal are equivalent to those of a multiplicative mixer with a gain of approximately unity. The technique is particularly useful for synchronized IF correlator systems where a function generator can serve to generate the modulation waveform and act as a coherent detector simultaneously. (Modified author abstract) GRA

N75-11169# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR S-BAND AMPLIFIER Triannual Report, 1 Jul. 1973 - 31 Jan. 1974
L. A. Roberts Aug. 1974 34 p refs
(Contract DAAB07-72-C-0220)
(AD-784666; W-J-22-4102-R4; ECOM-72-0220-4; TAR-4) Avail: NTIS CSCL 09/5

During the period, six diodes were placed on life test and successfully passed the required 1000 hours of operation with stable reverse breakdown voltage characteristics. Two operating S-band tubes were built and tested at 3 GHz. These tubes used pencil electron beams, mailbox helix deflection structures, and targets composed of diodes working into radial line resonators. Peak power output of 20.4 watts was achieved at a duty factor of 0.001. Author (GRA)

N75-11170# Universal Computer Applications Palo Alto, Calif.
COMPUTER AIDED DESIGN FOR DUAL TONE CFA Triannual Technical Report, 15 May - 15 Sep. 1973
Gerald P. Kooyers, Elden K. Shaw, and Patricia A. Vartanian Mar. 1974 54 p refs
(Contract DAAB07-73-C-0185)
(AD-784240; ECOM-0185-1-73) Avail: NTIS CSCL 09/5

A report is presented on a computer-aided research project to aid in the development of versatile dual operating-mode crossed field amplifiers. The year's tasks are summarized and a historical summary of previous research is presented. Results of studies made of simple grids neglecting the effects of space charge electric fields is presented. Progress on the development of a computer program to study electron guns using the mesh approach is described. Interaction equations of the CFA are developed in complex form. Author (GRA)

N75-11171# Avco Corp., Wilmington, Mass.
THE ELECTROSTATIC FIELD OF A DIELECTRIC FILLED SLOT
Jerrold M. Yos May 1974 43 p refs
(Contract F19628-72-C-0120; AF Proj. 4642)
(AD-784861; AVSD-0139-74-CR; AFCRL-TR-74-0305; SR-3) Avail: NTIS CSCL 09/5

The electrostatic field distribution around a dielectric filled slot is computed by a method which is believed to be new, in which the aperture field is expanded in a mixed Fourier series involving terms in both the cosine and the generalized Riemann zeta function. The resulting expansion is found to converge very rapidly, so that accurate numerical computations of the field distribution can be obtained using only a few terms in the expansion. Numerical results for the field distribution are presented for various values of the slot dielectric constant, and a simple approximate formula which represents the results of the numerical computations within an accuracy of about 10 percent is given. Author (GRA)

N75-11172# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FABRICATION OF ELECTRON-BOMBARDED SEMICONDUCTOR (EBS) DIODES
Barry E. Burke, Ronald A. Cohen, and Robert W. Mountain 29 Jul. 1974 68 p refs
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-784856; TN-1974-39; ESD-TR-74-236) Avail: NTIS CSCL 09/1

This report is a complete description of the design criteria and the processes used for the fabrication of electron-bombarded semiconductor diodes for Class C operation at 2.1 GHz and lower frequencies. The devices are planar p-n junction diodes fabricated on n/n(+) epitaxial material with a deep diffused guard ring surrounding the thin junction which the electron beam penetrates. Leakage currents are sufficiently low so that thermal runaway does not occur until the device temperature exceeds 350C. It is demonstrated that a Schottky barrier is not a good choice for these large area power devices due to higher leakage current, and that a p-n junction is to be preferred. However, a layer of metal was needed to reduce the net sheet resistance of the thin p+ junction and a thin (approximately 300A) sputtered film of molybdenum was shown to be a good choice in this case. The use of Mo-Au metalization proved to be a simple and reliable system for these devices. (Modified author abstract) GRA

N75-11004* Kanner (Leo) Associates, Redwood City, Calif.
HIGH FREQUENCY SWITCHING DEVICES
B. A. Prigoda, Ye. A. Vlasov, A. S. Markin, and E. I. Yakovlev *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974

p 217-221 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 143-146 (For availability see N75-10988 02-18)
CSCL 09A

N75-11005* Kanner (Leo) Associates, Redwood City, Calif.
SHF FILTERS IN SPACECRAFT ANTENNA-FEEDER SYSTEMS
Ye. A. Vlasov and B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 222-227 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 147-149 (For availability see N75-10988 02-18)
CSCL 09A

N75-11006* Kanner (Leo) Associates, Redwood City, Calif.
CHECKING THE PARAMETERS OF AFS IN SPACECRAFT IN FLIGHT
Ye. A. Vlasov, B. A. Prigoda, and A. S. Markin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 228-234 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 150-154 (For availability see N75-10988 02-18)
CSCL 09E

N75-11011* Kanner (Leo) Associates, Redwood City, Calif.
THE PROBLEM OF CONTROLLING THE DIRECTIVITY OF LOW DIRECTIVITY ANTENNAS ON SPACECRAFT IN FLIGHT
V. I. Mashkov and B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 335-338 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 219-220 (For availability see N75-10988 02-18)
CSCL 09E

N75-11012* Kanner (Leo) Associates, Redwood City, Calif.
SOME PROBLEMS OF THE DESIGN OF HIGHLY DIRECTIONAL SPACECRAFT ANTENNAS
B. A. Prigoda *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 339-352 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 221-229 (For availability see N75-10988 02-18)
CSCL 09E

N75-11284* Naval Research Lab., Washington, D.C.
DIGITAL FREQUENCY CONTROL OF SATELLITE FREQUENCY STANDARDS
Stephen A. Nichols *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 127-145 refs (For availability see N75-11275 02-35)
CSCL 09E

N75-11798 Joint Publications Research Service, Arlington, Va.
REQUIRED KNOWLEDGE ABOUT RESISTORS DESCRIBED
Atnas Atanasov *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 8-11 refs Transl. into ENGLISH from Voenna Tekhnika (Sofia), no. 8, 1974 p 28-29 (For availability see N75-11796 02-81)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N75-11173*# Martin Marietta Corp., Denver, Colo.
A FEASIBILITY STUDY OF DEVELOPING TOROIDAL TANKS FOR A SPINNING SPACECRAFT. PART 2: EVALUATION OF FLUID BEHAVIOR IN SPINNING TOROIDAL TANKS
Final Report
John E. Anderson Oct. 1974 59 p refs
(Contract NAS2-7489)
(NASA-CR-137584; MCR-74-372-Pt-2) Avail: NTIS HC $4.25 CSCL 20D

An experimental program was conducted for the purpose of evaluating propellant behavior characteristics in spinning toroidal tanks. The effects of typical mission requirements, and related phenomena upon propellant slosh and settling, and orientation and stability of the ullage were investigated in a subscale model tank under both one-g and low-g acceleration environments. Specific conditions included were axial acceleration, spin rate, spinrate change, and spacecraft wobble, both singly and in combination. Methanol and water in combination with appropriate spin-rates and accelerations of the scale model system were used to simulate the behavior of fluorine, nitrogen tetroxide, monomethylhydrazine, and hydrazine. The experimental results indicate that no major fluid behavior problems would be encountered with the use of toroidal tanks containing any of the four propellants in a proposed spin-stabilized orbiter spacecraft. Author

N75-11174*# Pennsylvania State Univ., University Park.
FLUID MECHANICS, ACOUSTICS, AND DESIGN OF TURBOMACHINERY, PART 1
B. Lakshminarayana, ed., W. R. Britsch, ed. (NASA. Lewis Res. Center), and W. S. Gearhart, ed. Washington NASA 1974 419 p refs Proc. of a Symp. held at University Park, Pa., 31 Aug.-3 Sep. 1970; sponsored by NASA, Pennsylvania State Univ. and the Navy Sponsored by NASA
(NASA-SP-304-Pt-1; LC-72-600087-Pt-1) Avail: NTIS MF $2.25; SOD HC $3.75 CSCL 20D

A conference was conducted to analyze the effects of air flow on turbomachinery design. The subjects discussed are: (1) equations for compressible flow through turbomachines, (2) influence of axial velocity ratio on cascade performance, (3) three dimensional flow in transonic axial compressor blade rows, (4) prediction of turbulent shear layers in turbomachines, and (5) boundary layers in centrifugal compressors. For individual titles, see N75-11175 through N75-11190.

N75-11175* Cambridge Univ. (England).
KEYNOTE ADDRESS
J. H. Horlock *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design on Turbomachinery, Pt. 1 1974 p 1-5 refs (For availability see N75-11174 02-34)
CSCL 20D

The requirements for a conference on turbomachinery aerodynamics and hydrodynamics are examined. The subject range of the conference is identified as basic fluid mechanics, propulsion aspects of the field, and design applications to turbomachines using gases and liquids. Background information is provided on the field of hydrodynamic and aerodynamic applications. The investigation of boundary layer theory and acoustics in the area of unsteady fluid mechanics is reported. The remaining challenge to synthesize the disciplines into the design of process of turbomachinery is explained. Author

N75-11176* Pennsylvania State Univ., University Park.
TURBOMACHINERY DESIGN DESCRIBED BY SIMILARITY CONSIDERATIONS c37
George F. Wislicenus *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 7-39 refs Sponsored by NASA (For availability see N75-11174 02-34)
CSCL 21E

Expressions of operating conditions related to the design of turbomachinery are examined. The dimensionless field of turbomachinery design is discussed. The relationships of dimensionless design parameters such as diameter ratios, flow coefficients, head coefficients, and design choices regarding the fluid and the machine are explained. The core of the design process is said to relate such sets of design parameters to the dimensionless form of the machine. Mathematical models are provided to support the theoretical considerations. Author

N75-11177* National Gas Turbine Establishment, Farnborough (England).
COMPUTER SOLUTIONS OF WU'S EQUATIONS FOR

COMPRESSIBLE FLOW THROUGH TURBOMACHINES
D. J. L. Smith *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 43-74 refs (For availability see N75-11174 02-34)
CSCL 20D

Two computers programs, known as Matrix Through-Flow and Matrix Blade-To-Blade, for analyzing the meridional and blade-to-blade flow patterns are described. The numerical solutions are obtained by finite difference approximations to the governing Poisson-type differential equations for the stream function. Solutions for several turbomachines, giving flow patterns and velocity distributions, are included. Author

N75-11178* Rolls-Royce, Ltd., Derby (England).
MATRIX METHODS FOR THE DESIGN OF CASCADES TO PRESCRIBED SURFACE VELOCITY DISTRIBUTIONS AND FOR FULLY COMPRESSIBLE FLOW
M. E. Silvester and C. M. Fitch *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 75-100 refs (For availability see N75-11174 02-34)
CSCL 20D

This paper describes matrix methods that have been developed for calculating compressible flow on a blade-to-blade surface of revolution. The methods have been fully tested to date only for the design of plane cascades to prescribed blade surface distributions; the methods will be illustrated here for that problem only. Similar methods are presently being applied to both the direct and indirect problems and for flow on arbitrary surfaces of revolution in annular cascades with stream sheet thickness variations. It is believed that by such methods, both the direct and indirect caclulations can be reduced to about 60 to 90 seconds of computing. Author

N75-11179* California Inst. of Tech., Pasadena.
A NOTE ON THE INFLUENCE OF AXIAL VELOCITY RATIO ON CASCADE PERFORMANCE
M. B. Wilson, R. Mani (Mass. Univ.), and A. J. Acosta *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 101-133 refs (For availability see N75-11174 02-34)
(Contract Nonr-220(59))
CSCL 20D

A thin airfoil quasi-two-dimensional potential flow theory has been used to analyze cascades with axial-flow contraction. Attention is centered on the flow turning of a lattice of foils as measured by the deviation angle. The influence of both axial-flow acceleration and foil thickness on the deviation angle is summarized in plots that should be useful for design purposes. It is shown that the effect of axial-flow contraction is larger when the foils are relatively far apart than when they are close together. The influence of axial velocity ratio across the cascade changes markedly with the stagger angle. These effects are essentially unaltered due to foil thickness. Author

N75-11180* Aston Univ., Birmingham (England).
THE SOLUTION OF THREE-VARIABLE DUCT-FLOW EQUATIONS
A. R. Stuart and R. Hetherington (Rolls-Royce Ltd.) *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 135-153 refs (For availability see N75-11174 02-34)
CSCL 20D

This paper establishes a numerical method for the solution of three-variable problems and is applied here to rotational flows through ducts of various cross sections. An iterative scheme is developed, the main feature of which is the addition of a duplicate variable to the forward component of velocity. Two forward components of velocity result from integrating two sets of first order ordinary differential equations for the streamline curvatures, in intersecting directions across the duct. Two pseudo-continuity equations are introduced with source/sink terms, whose strengths are dependent on the difference between the forward components of velocity. When convergence is obtained, the two forward components of velocity are identical, the source/sink terms are zero, and the original equations are satisfied. A computer program solves the exact equations and boundary conditions numerically. The method is economical and compares successfully with experiments on bent ducts of circular and rectangular cross section where secondary flows are caused by gradients of total pressure upstream. Author

N75-11181* Massachusetts Inst. of Tech., Cambridge.
THREE-DIMENSIONAL FLOW IN TRANSONIC AXIAL COMPRESSOR BLADE ROWS
J. E. McCune and Olufemi Okurounmu (Lagos Univ.) *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 155-172 refs Sponsored in part by United Aircraft Corp. (For availability see N75-11174 02-34)
CSCL 20D

Recent developments in the three-dimensional aerodynamic theory of inviscid flow in transonic axial compressors are reviewed. Emphasis is placed on the newly completed lifting surface theory of a transonic ducted rotor. The relationship between the lifting surface theory and axisymmetric through-theories of turbomachines is illustrated; a few examples of the additional information obtainable from the new theory are then given. Quasi-two-dimensional cascade theory can also be extracted from the present analysis and the relevance of cascade theory to the actual three-dimensional problem assessed. Details are reported elsewhere, but some of the qualitative conclusions are discussed here. Even moderate departure from uniform spanwise loading of the rotor blades, for example, leads to a rather profound influence of the downstream wakes, suggesting the need for considerable care in applying cascade data on a direct quasi-two-dimensional basis. Author

N75-11182* Liverpool Univ. (England).
SECONDARY VORTICITY IN AXIAL COMPRESSOR BLADE ROWS
S. L. Dixon *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 173-204 refs (For availability see N75-11174 02-34)
CSCL 20D

A theoretical investigation of secondary flow in compressor blade rows is presented. Formulas for calculating secondary flows in annular cascade blade passages are derived. The influence of the relative rotation vector on secondary velocity perturbations, using recent developments in shear-flow theory, is examined. A method of calculating the flow through successive blade rows is given and a comparison is made with experimental results. Author

N75-11183* Stanford Univ., Calif.
THE EFFECTS OF ROTATION ON BOUNDARY LAYERS IN TURBOMACHINE ROTORS
James P. Johnston *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 207-249 refs (For availability see N75-11174 02-34)
(Grant NSF GK-2533)
CSCL 20D

The boundary layers in turbomachine rotors are subject to Coriolis forces which can (1) contribute directly to the development of secondary flows and (2) indirectly influence the behavior of boundary layers by augmentation and/or suppression of turbulence production in the boundary layers on blades. Both these rotation-induced phenomena are particularly important in the development of understanding of flow and loss mechanisms in centrifugal and mixed flow machines. The primary objective of this paper is to review the information available on these effects. Author

N75-11184* Imperial Coll. of Science and Technology, London (England).
PREDICTION OF TURBULENT SHEAR LAYERS IN TURBOMACHINES
P. Bradshaw *In* Pennsylvania State Univ. Fluid Mech., Acoustic, and Design of Turbomachinery, Pt. 1 1974 p 251-277 refs (For availability see N75-11174 02-34)
CSCL 20D

The characteristics of turbulent shear layers in turbomachines are compared with the turbulant boundary layers on airfoils. Seven different aspects are examined. The limits of boundary layer theory are investigated. Boundary layer prediction methods are applied to analysis of the flow in turbomachines. Author

N75-11185* Colorado State Univ., Fort Collins.
BOUNDARY LAYER SEPARATION AND REATTACHMENT
V. A. Sandborn *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 279-299 refs (For availability see N75-11174 02-34)
(Contract N00014-68-A-0493-0001; Proj. THEMIS)
CSCL 20D

A review of developments in a new model for boundary-layer separation is presented. The separation model encompasses timevarying as well as steady-flow conditions. Engineering criteria in terms of calculable pressure gradients are obtained for both laminar and turbulent boundary-layer separation. These criteria, together with limited information on time-dependent separations, should be of value in predicting flows in turbomachinery. The reattachment of boundary layers is also shown to fit within the separation model. Author

N75-11186* Creare, Inc., Hanover, N.H.
BOUNDARY LAYERS IN CENTRIFUGAL COMPRESSORS
Robert C. Dean, Jr. *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 301-337 refs (For availability see N75-11174 02-34)
CSCL 20D

The utility of boundary-layer theory in the design of centrifugal compressors is demonstrated. Boundary-layer development in the diffuser entry region is shown to be important to stage efficiency. The result of an earnest attempt to analyze this boundary layer with the best tools available is displayed. Acceptable prediction accuracy was not achieved. The inaccuracy of boundary-layer analysis in this case would result in stage efficiency prediction as much as four points low. Fluid dynamic reasons for analysis failure are discussed with support from flow data. Empirical correlations used today to circumnavigate the weakness of the theory are illustrated. Author

N75-11187* California Inst. of Tech., Pasadena.
PHYSICAL EFFECTS IN CAVITATING FLOWS
Milton S. Plesset *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 341-354 refs (For availability see N75-11174 02-34)
CSCL 20D

The microscopic and macroscopic aspects of the physical effects of cavitating flows are discussed. The microscopic features are related to the properties of nuclei in liquids and to the moderate tensile strengths which are usually encountered in flows. The macroscopic features are concerned with the growth of vapor or gaseous cavities from a small initial size and with their eventual collapse. Mathematical models are developed to analyze the characteristics of: (1) tensile strength in liquids, (2) growth of vapor bubbles, and (3) collapse of vapor bubbles. Author

N75-11188* General Electric Co., New York.
SOME EFFECTS OF APPLIED STRESS ON EARLY STAGES OF CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt (Mich. Univ.) *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 355-376 refs (For availability see N75-11174 02-34)
(Grant NSF GK-1889)
CSCL 20D

The phenomenon of cavitation flow damage is discussed. The initial phases of damage and the effect of external stresses on the extent to which damage is incurred are analyzed. Three experimental facilities were used to procure the data required: (1) a water loop with venturi, (2) a mercury loop with venturi, and (3) a vibratory facility (stationary specimen, nonflow system). A description of each system is provided for the clarification of test conditions. Photographs of typical cavitation damage instances are included. Author

N75-11189* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL STUDIES ON THERMODYNAMIC EFFECTS OF DEVELOPED CAVITATION c77
Robert S. Ruggeri *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 377-401 refs (For availability see N75-11174 02-34)
CSCL 20M

A method for predicting thermodynamic effects of cavitation (changes in cavity pressure relative to stream vapor pressure) is presented. The prediction method accounts for changes in liquid, liquid temperature, flow velocity, and body scale. Both theoretical and experimental studies used in formulating the method are discussed. The prediction method provided good agreement between predicted and experimental results for geometrically scaled venturis handling four different liquids of widely diverse physical properties. Use of the method requires geometric similarity of the body and cavitated region and a known reference cavity-pressure depression at one operating condition. Author

N75-11190* California Univ., San Diego.
NON-NEWTONIAN EFFECTS ON FLOW-GENERATED CAVITATION AND ON CAVITATION IN A PRESSURE FIELD
Albert T. Ellis and Robert Y. Ting *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 403-421 refs (For availability see N75-11174 02-34)
(Contract N00014-67-A-0109-0007)
CSCL 20D

Observations are presented which show that the stresses in a flow field of very dilute polymer are not well enough described by the Navier-Stokes equations to accurately predict cavitation. The contitutive equation for the particular polymer and concentration used is needed. The second-order fluid form in which accelerations are relatively important appears capable of explaining observed cavitation suppression by changing the pressure field due to flow. Bubble dynamics in stationary dilute polymer solutions are also examined and found to be little different from those in water. Author

N75-11191*# Pennsylvania State Univ., University Park.
FLUID MECHANICS, ACOUSTICS, AND DESIGN OF TURBOMACHINERY, PART 2
B. Lakshminarayana, ed., W. R. Britsch, ed. (NASA. Lewis Res. Center), and W. S. Gearhart, ed. Washington NASA 1974 447 p refs Symp. held at University Park, Pa., 31 Aug.-3 Sep. 1970; sponsored by NASA, Pennsylvania State Univ., and the Navy Sponsored in part by NASA
(NASA-SP-304-Pt-2; LC-72-600087-Pt-2) Avail: NTIS MF $2.25; SOD HC $3.80 CSCL 13K

A conference was conducted to investigate various parameters involved in the design of turbomachinery. The acoustic properties of compressor rotors at subsonic speeds are described to show the sources of sound in fluid flows and sound radiation from the rotors. The design criteria for turbomachinery are examined to show impeller design methods, transonic compressor technology, and blade selection for an axial flow compressor. Specific applications of turbomachinery used as pumps for aerospace applications and turbomachinery for marine propulsion are described. For individual titles, see N75-11192 through N75-11208.

N75-11192* Imperial Coll. of Science and Technology, London (England).
SOURCES OF SOUND IN FLUID FLOWS
J. E. Ffowcs Williams *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 425-434 refs (For availability see N75-11191 02-34)
CSCL 20D

Some features of a flow that produce acoustic radiation, particularly when the flow is turbulent and interacting with solid surfaces such as turbine or compressor blades are discussed. Early theoretical ideas on the subject are reviewed and are shown to be inadequate at high Mach number. Some recent theoretical developments that form the basis of a description of sound generation by supersonic flows interacting with surfaces are described. At high frequencies the problem is treated as one of describing the surface-induced diffraction field of adjacent aerodynamic quadrupole sources. This approach has given rise to distinctly new features of the problem that seem to have bearing on the radiating properties of relatively large aerodynamic surfaces. Author

N75-11193* Pratt and Whitney Aircraft, East Hartford, Conn.
MULTIPLE PURE TONE NOISE GENERATED BY FANS AT SUPERSONIC TIP SPEEDS

T. G. Sofrin and G. F. Pickett *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 435-459 refs Sponsored by FAA (For availability see N75-11191 02-34)
CSCL 20D

The existence of clusters of pure tones at integral multiples of shaft speed has been noted for supersonic-tip-speed operation of fans and compressors. A continuing program to explore this phenomenon, often called combination-tone noise, has been in effect for several years. This paper reviews the research program, which involves a wide range of engines, compressor rigs, and special apparatus. Elements of the aerodynamics of the blade-associated shock waves are outlined and causes of blade-to-blade shock inequalities, responsible for the multiple tones, are described. Author

N75-11194* Southampton Univ. (England). Inst. of Sound and Vibration Research.
BROADBAND SOUND RADIATED FROM SUBSONIC ROTORS
C. L. Morfey *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 461-492 refs (For availability see N75-11191 02-34)
CSCL 20D

Recent theoretical work on sound sources in subsonic turbomachinery is applied to the correlation of axial-flow fan and compressor noise measurements. Correlations are presented for directivity and sound-power spectra associated with broadband noise. A simple explanation is given to account for the relative amounts of sound power transmitted upstream and downstream from a single-stage fan. Author

N75-11195* Pennsylvania State Univ., University Park.
SOUND RADIATION FROM A SUBSONIC ROTOR SUBJECTED TO TURBULENCE
M. Sevik *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 493-512 refs (For availability see N75-11191 02-34)
CSCL 20D

The broadband sound radiated by a subsonic rotor subjected to turbulence in the approach stream has been analyzed. The power spectral density of the sound intensity has been found to depend on a characteristic time scale-namely, the integral scale of the turbulence divided by the axial flow velocity-as well as several length-scale ratios. These consist of the ratio of the integral scale to the acoustic wavelength, rotor radius, and blade chord. Due to the simplified model chosen, only a limited number of cascade parameters appear. Limited comparisons with experimental data indicate good agreement with predicted values. Author

N75-11196* Massachusetts Univ., Amherst.
COMPRESSIBILITY EFFECTS IN THE KEMP-SEARS PROBLEM
Ramani Mani *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 513-533 refs (For availability see N75-11191 02-34)

The effects of including compressibility in the Kemp-Sears problem of aerodynamic interference between moving blade rows are examined. Methods of linearized, subsonic, plane, unsteady flow are adopted. The major new effect is that a resonance appears at certain combinations of flow Mach number, tip Mach number, and blade vane ratios. The resonance is at exactly the Tyler-Sofrin cutoff condition for rotor-stator interaction. At such conditions the unsteady lift on a blade row due to externally imposed nonstationary upwash vanishes. However, the resonance appears to be very sharp and seems to be more significant as an indication that around this condition the unsteady lift changes very rapidly. Author

N75-11197* Northern Research and Engineering Corp., London (England).
IMPELLER BLADE DESIGN METHOD FOR CENTRIFUGAL COMPRESSORS c37
Willem Jansen and Andreas M. Kirschner *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 537-563 refs (For availability see N75-11191 02-34)
CSCL 13K

The design of a centrifugal impeller with blades that are aerodynamically efficient, easy to manufacture, and mechanically sound is discussed. The blade design method described here satisfies the first two criteria and with a judicious choice of certain variables will also satisfy stress considerations. The blade shape is generated by specifying surface velocity distributions and consists of straight-line elements that connect points at hub and shroud. The method may be used to design radially elemented and backward-swept blades. The background, a brief account of the theory, and a sample design are described. Author

N75-11198* General Electric Co., New York.
CALCULATION OF FLOW DISTRIBUTION IN LARGE RADIUS RATIO STAGES OF AXIAL FLOW TURBINES AND COMPARISON OF THEORY AND EXPERIMENT
Josef Herzog *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 565-580 refs (For availability see N75-11191 02-34)
CSCL 20D

A method of calculating stage parameters and flow distribution of axial turbines is described. The governing equations apply to space between the blade rows and are based on the assumption of rotationally symmetrical, compressible, adiabatic flow conditions. Results are presented for stage design and flow analysis calculations. Theoretical results from the calculation system are compared with experimental data from low pressure steam turbine tests. Author

N75-11199* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSONIC COMPRESSOR TECHNOLOGY ADVANCEMENTS c37
William A. Benser *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 581-602 refs (For availability see N75-11191 02-34)
CSCL 13K

The highlights of the NASA program on transonic compressors are presented. Effects of blade shape and throat area on losses and flow range are discussed. Some effects of casing treatment on stall margin are presented. Results of tests with varying solidity are also presented. High Mach number, highly loaded stators are discussed and some results of stator hub slit suction are presented. Author

N75-11200* AiResearch Mfg. Co., Los Angeles, Calif.
BLADE SELECTION FOR A MODERN AXIAL-FLOW COMPRESSOR c37
L. C. Wright *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 603-626 refs (For availability see N75-11191 02-34)
CSCL 13K

The procedures leading to successful design of an axial flow compressor are discussed. The three related approaches to cascade selection are: (1) experimental approach which relies on the use of experimental results from identical cascades to satisfy the velocity diagrams calculated, (2) a purely analytical procedure whereby blade shapes are calculated from the theoretical cascade and viscous flow equations, and (3) a semiempirical procedure which used experimental data together with the theoretically derived functional relations to relate the cascade parameters. Diagrams of typical transonic blade sections with uncambered leading edges are presented. Author

N75-11201* Rocketdyne, Canoga Park, Calif.
AXIAL PUMPS FOR PROPULSION SYSTEMS
M. C. Huppert and K. Rothe *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 629-654 refs (For availability see N75-11191 02-37)
CSCL 13K

The development of axial flow hydrogen pumps is examined. The design features and the performance data obtained during the course of the development programs are discussed. The problems created by the pump characteristics are analyzed. Graphs of four stage pump performance for various turbine blade configurations are developed. The characteristics and performance of a variety of pumps are included. Author

N75-11202* Aerojet Nuclear Systems Co., Azusa, Calif. NERVA Rocket Operations.
CENTRIFUGAL PUMPS FOR ROCKET ENGINES c37
W. E. Campbell and J. Farquhar *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 655-688 refs Sponsored jointly by NASA and AEC (For availability see N75-11191 02-34)
CSCL 13K

The use of centrifugal pumps for rocket engines is described in terms of general requirements of operational and planned systems. Hydrodynamic and mechanical design considerations and techniques and test procedures are summarized. Some of the pump development experiences, in terms of both problems and solutions, are highlighted. Author

N75-11203* Pennsylvania State Univ., University Park.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF FLOW THROUGH ROCKET PUMP INDUCER
B. Lakshminarayana *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 689-731 refs (For availability see N75-11191 02-34)
(Grant NGL-39-009-007)
CSCL 20D

The characteristics of a rocket pump inducer are discussed. The effect of the pumping requirements on the blade configuration is analyzed. The effects of viscosity on blade design were determined by tests of a four bladed inducer operated in air at a flow coefficient of 0.065. The fluid properties were measured at the exit of the inducer using conventional and hot wire probes. The experimental results and the method of predicting the outlet tangential velocity and head rise are discussed. Author

N75-11204* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF PUMP CAVITATION PERFORMANCE
Royce D. Moore *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 733-755 refs (For availability see N75-11191 02-34)
CSCL 20D

A method for predicting pump cavitation performance with various liquids, liquid temperatures, and rotative speeds is presented. Use of the method requires that two sets of test data be available for the pump of interest. Good agreement between predicted and experimental results of cavitation performance was obtained for several pumps operated in liquids which exhibit a wide range of properties. Two cavitation parameters which qualitatively evaluate pump cavitation performance are also presented. Author

N75-11205* Pennsylvania State Univ., University Park.
AN INTRODUCTION TO THE DESIGN OF MARINE PROPULSORS c37
Robert E. Henderson *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 759-765 refs (For availability see N75-11191 02-34)
CSCL 13K

A summary of methods for marine propulsion design is presented. A list of reports dealing with the design of open propellers, ducted propellers or pumpjets, and waterjets is included. The major problems involved in marine propulsion design are discussed. Author

N75-11206* Naval Ship Research and Development Center, Washington, D.C.
APPLICATION OF THEORY TO PROPELLER DESIGN c37
G. G. Cox and William B. Morgan *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 767-793 refs (For availability see N75-11191 02-34)
CSCL 13K

The various theories concerning propeller design are discussed. The use of digital computers to obtain specific blade shapes to meet appropriate flow conditions is emphasized. The development of lifting-line and lifting surface configurations is analyzed. Ship propulsive performance and basic propeller design considerations are investigated. The characteristics of supercavitating propellers are compared with those of subcavitating propellers. Author

N75-11207* Pennsylvania State Univ., University Park.
THE DESIGN OF PUMPJETS FOR HYDRODYNAMIC PROPULSION c37
Edgar P. Bruce, Walter S. Gearhart, John R. Ross, and Allen L. Treaster *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 795-839 refs (For availability see N75-11191 02-34)
(Contract N00017-70-C-1407)
CSCL 13K

A procedure for use in the design of a wake adapted pumpjet mounted on the aft end of a body of revolution is presented. To this end, a pumpjet is designed for the Akron airship. The propulsor mass flow is selected to minimize kinetic energy losses through the duct and in the discharge jet. The shaft speed and disk size are selected to satisfy specified limits of cavitation performance and to provide acceptable blade loading. The streamtubes which pass through a propulsor mounted on a tapered afterbody follow essentially conical surfaces. A method is provided for defining these surfaces as a function of shroud geometry, rotor head distribution, and the energy distribution of the ingested mass flow. The three-dimensional effects to which the conical flow subjects the cylindrical blade design sections are described and a technique is presented which permits incorporation of these effects in the blade design procedure. Author

N75-11208* Aerojet-General Corp., El Monte, Calif.
THEORY OF ONE-ELEMENT PUMPS FOR PROPULSION c37
Joseph Levy *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 841-859 refs (For availability see N75-11191 02-34)
(Contract N00014-66-C-0014)
CSCL 13K

A basic theory for one-element propulsion pumps is developed. A limit to the obtainable efficiency is established and relationships among pump-performance parameters that result in the greatest efficiency are indicated. It is shown that the peripheral velocity of the pump is directly related to ship speed and some relationships between performance parameters and pump geometry are developed. Mathematical models of pump performance are included. Author

N75-11209*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF FLOW FIELDS OF ANNULAR JETS WITH AND WITHOUT SWIRLING FLOW
M. R. Simonson, E. G. Smith, and W. R. Uhl Jun. 1974 159 p refs
(Contract NAS2-5462)
(NASA-CR-137536; R74AEG265) Avail: NTIS HC $6.25 CSCL 20D

Analytical and experimental studies were performed to define the flowfield of annular jets, with and, without swirling flow. The analytical model treated configurations with variations of flow angularities, radius ratio, and swirl distributions. Swirl distributions characteristic of stator vanes and rotor blade rows, where the total pressure and swirl distributions are related were incorporated in the mathematical model. The experimental studies included tests of eleven nozzle models, both with and, without swirling exhaust flow. Flowfield surveys were obtained and used for comparison with the analytical model. This comparison of experimental and analytical studies served as the basis for evaluation of several empirical constants as required for application of the analysis to the general flow configuration. The analytical model developed during these studies is applicable to the evaluation of the flowfield and overall performance of the exhaust of statorless lift fan systems that contain various levels of exhaust swirl. Author

N75-11210*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY OF MULTILAYERED INSULATION PIPE PENETRATION. THERMAL ACOUSTIC OSCILLATION Quarterly Progress Report, 26 Jul. - 25 Oct. 1974
Juan K. Lovin 7 Nov. 1974 39 p refs
(Contract NAS8-26642)
(NASA-CR-120527; LMSC-HREC-PR-D390426) Avail: NTIS

HC $3.75 CSCL 20M

Tests were conducted to determine the net heat leak to a source of liquid nitrogen caused by a metal penetration through the blanket of multilayer insulation. The conditions under which the tests were conducted are described. A graph of the theoretical and experimental temperature distribution is developed for comparison. The variables involved in the computer program to process the data are defined. A study was conducted to develop analytical methods for predicting the effect and magnitudes of thermoacoustic oscillations on the penetration heat leak to cryogens. The oscillations develop as a result of large thermal gradients imposed on a compressible fluid. The predominant amplitudes and frequencies of the thermal acoustic oscillations were investigated. Author

N75-11211*# Boeing Co., Wichita, Kans.

ACOUSTIC ATTENUATION ANALYSIS PROGRAM FOR DUCTS WITH MEAN FLOW

R. K. Kunze, Jr. 17 Aug. 1972 95 p refs

(Contract NAS3-14321)

(NASA-CR-120985; D3-8677) Avail: NTIS HC $4.75 CSCL 20D

A computerized acoustic attenuation prediction procedure has been developed to evaluate acoustically lined ducts for various geometric and environmental parameters. The analysis procedure is based on solutions to the acoustic wave equation, assuming uniform airflow on a duct cross section, combined with appropriate mathematical lining impedance models. The impedance models included in the analysis procedure are representative of either perforated sheet or porous polyimide impregnated fiberglass facing sheet coupled with a cellular backing space. Advantages and limitations of the analysis procedure are reviewed. Author

N75-11212# Royal Aircraft Establishment, Farnborough (England).

THE BEHAVIOUR OF DROPS IN HIGH VELOCITY GAS JETS

W. Korner Jun. 1974 40 p refs Transl. into ENGLISH from Acta Mech. (West Germany), v. 13, 1972 p 87-115

(RAE-Lib-Trans-1766; BR42349) Avail: NTIS HC $3.75

A drop of a liquid with low viscosity is suddenly exposed to a gaseous jet with high relative velocity. The drop is destroyed due to both the shear stress and the normal stress exerted by the jet flowing past the drop. By use of suitable model concepts and simplifying assumptions, solutions are derived for the fluid flow in the vicinity of the symmetry axis of the drop and in the coupled liquid and gaseous boundary layers at the drop's front face. Deformation and mass loss of the drop are determined from the liquid flow fields. Finally, a comparison is presented of pertinent experimental data taken from the literature and of numerical evaluations of the theory outlined in this paper. Author

N75-11213# Sandia Labs., Albuquerque, N.Mex.

RADIAL BASE HEAT-TRANSFER GRADIENTS IN TURBULENT FLOW

B. M. Bulmer May 1974 18 p refs

(Contract AT(29-1)-789)

(SLA-74-230) Avail: NTIS HC $3.25

An experimental analysis of radial base heat-transfer gradients was conducted to determine the application to base heatshield design for various hypersonic entry vehicles. A geometric relation is derived from previous results to determine the radial base heat-transfer distribution for a slender cone at zero angle of attack. Turbulent heat transfer is shown to vary nearly linearly across a flat base. Comparisons with available ground and flight test data indicate that the distribution is not strongly influenced by forebody configuration or flow conditions. The afterbody configuration appears to have an effect on the turbulent heat-transfer distribution. Author

N75-11214# Los Alamos Scientific Lab., N.Mex.

PERFORMANCE TESTS OF GRAVITY-ASSIST HEAT PIPES WITH SCREEN WICK STRUCTURES

J. E. Kemme, J. E. Deverall, E. S. Keddy, J. R. Phillips, and W. A. Ranken 1973 17 p refs Presented at the Thermophysics and Heat Transfer Conf., Boston, 15 Jul. 1974 Sponsored by AEC

(LA-UR-74-212; Conf-740705-1) Avail: NTIS HC $3.25

The equipment and procedures used in the performance testing of sodium heat pipes operating in the gravity-assist mode are described. These tests showed that superheat limitations are a major factor to be overcome in wick design and wick fabrication methods. Oversize voids adjacent to the heat-pipe wall tend to become the loci of vapor pockets which block heat transfer through the wick and seriously reduce performance, particularly at relatively high working-fluid vapor pressures. In general, wick imperfections which may be inconsequential or even beneficial under gravity-neutral operating conditions, are likely to have a performance-limiting effect for gravity-assist operation. Some of the tests also indicate that the performance of gravity-assist heat pipes may be limited by interactions between vapor and liquid. Tests are now being conducted with helical baffles which should provide protected flow paths of low impedance for the returning liquid. Author (NSA)

N75-11215# California Univ., Berkeley. Lawrence Berkeley Lab.

NUMERICAL STUDY OF VISCOUS FLOWS PAST A CIRCULAR CYLINDER: APPLICATION OF CHORIN'S METHOD

B. Davari Dec. 1973 59 p refs

(Contract W-7405-eng-48)

(LBL-2480) Avail: NTIS HC $4.25

Chorin's Method of numerical solution of the Navier-Stokes Equations slightly viscous flows is applied to the problem of an impulsively started cular cylinder. The drag of the cylinder is computed over a range of = 10 to Re = 10 to the 5th power, and the validity of the results is discussed. Author

N75-11216# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

GASEOUS DISPERSION INTO STRATIFIED BUILDING WAKES

B. T. Yang and R. N. Meroney Aug. 1970 114 p refs

(Contract AT(11-1)-2053)

(COO-2053-3) Avail: NTIS HC $5.25

The dispersion of gases in the atmospheric boundary layer released from an elevated source may be predicted by numerous semi-empirical formulas; however, very little information is available to describe the dispersion within the cavity-wake region downwind of a leaking structure. Results are reported of the first wind tunnel phase of a joint field and wind tunnel program in which Kr-88 was used as a tracer to evaluate the wind tunnel as a site analysis tool for nuclear safety investigations. A series of diffusion measurements are tabulated for a simple cubical structure placed at different orientations in a stratified shear layer. Author (NSA)

N75-11217# Army Foreign Science and Technology Center, Charlottesville, Va.

PROPERTIES OF THE BOUNDARY LAYER IN SELECTIVE TRANSPORT

G. P. Shpenkov, D. N. Garkunov, V. Ya. Matyushenko, and B. D. Kharkhasov 12 Apr. 1974 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 5, 1973 p 41-45

(AD-784148; FSTC-HT-23-320-74) Avail: NTIS CSCL 11/8

The boundary layer of a lubricant induced when friction is present in selective transport (ST) conditions is investigated. Based on the determining roles of electrochemical processes as affecting the ST mechanism, the galvano-emf, rectified voltage, and resistance of the boundary layer are analyzed as functions of the rated load. GRA

N75-11218# Army Foreign Science and Technology Center, Charlottesville, Va.

ANALYSIS OF SWITCHING TIMES IN THE COANDA-EFFECT RELAY

A. B. Andreev and S. L. Treskunov 1 Apr. 1974 17 p refs Transl. into ENGLISH from the Proceedings of the 4th Intern. Fluidics Conf. (Varna), 14-18 Oct. 1972 10 p

(AD-784166; FSTC-HT-23-1640-73) Avail: NTIS CSCL 13/7

A theory based on turbulent jet entrainment and quasisteady flow assumed is presented for predicting switching times in a turbulent reattachment fluidic amplifier. Conditions of hydrodynam-

ic analogy for analysis of steady and nonsteady regimes of full-sized fluidic relays and large-scale relay models are discussed. Author (GRA)

N75-11219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POSSIBILITY OF DISSOCIATION REACTIONS OCCURRING IN POLYATOMIC MOLECULES DURING RAPID COOLING IN AN EXPANDING SUPERSONIC FLOW

P. S. Zaslonko, S. M. Kogarko, and Yu. V. Chirikov 15 Aug. 1974 14 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 2, Mar./Apr. 1973 p 48-53

(AD-784711; FTD-HT-23-785-74) Avail: NTIS CSCL 07/4

Studied is the possibility of the occurrence of the dissociation reaction of N2O and the exchange reaction of N2O-CO to N2-CO2 in rapid cooling of a gas mixture as a result of supersonic expansion in a nozzle. Balance equation for vibrational energy and the kinetics of the chemical reaction under nonequilibrium conditions are solved numerically. The values of parameters necessary for experimental observations of the studied phenomenon are found. GRA

N75-11220# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

THE STUDY OF FLUORINE DISSOCIATION BEHIND A REFLECTED SHOCK WAVE Final Report, Jul. 1972 - May 1974

Charles R. Mastromonico May 1974 82 p refs

(AF Proj. 314810SG)

(AD-783247; AFRPL-TR-74-33) Avail: NTIS CSCL 07/4

The dissociation of fluorine was studied behind a reflected shock wave in a reflected shock tube coupled to a time-of-flight mass spectrometer. Using mixtures of 0.5% F2 in Ar, dissociation rate constants and equilibrium constants were determined over the temperature range 1575 - 2540K by following the time rate of change of the mole fractions of F2 and F atoms. Activation energy and heat of dissociation are reported. Experimental apparatus and design are discussed. GRA

N75-11221# Army Foreign Science and Technology Center, Charlottesville, Va.

INTERPENETRATING MOTION OF VISCOUS AND VISCOPLASTIC INCOMPRESSIBLE LIQUIDS

V. P. Nochevko and V. E. Gubin 22 Apr. 1974 14 p refs Transl. into ENGLISH from Nauchn. Issled. Inst. po Transportu i Khraneniyu Nefti i Nefteproduktov, Uva, Tr. (USSR), no. 7, 1970 p 59-68

(AD-783657; FSTC-HT-23-1660-73) Avail: NTIS CSCL 20/4

The transportation of petroleum in a mixture with an aqueous solution of surfactants is regarded as the interpenetrating motion of two immiscible liquids. Expressions are derived for the stresses in the motion of these two liquids. GRA

N75-11222# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

EXPERIMENTAL STUDY OF THE SWITCHING CHARACTERISTICS OF BISTABLE AMPLIFIERS IN THE TURBULENT FLOW REGIME

Guy Bekaert and Mario Carbonaro Jan. 1974 75 p refs

(Contract DAJA37-73-C-1212)

(AD-782892) Avail: NTIS CSCL 13/7

A parametric investigation was conducted on a large scale model of a wall attachment bistable amplifier, with the object of measuring the switching times, as well as the steady state pressure distributions on the bistable walls and at the bistable output. As a first approach bistable configurations having no vents or splitter but only two straight attachment walls of variable length, set-back and angle, have been studied. Experimental data was obtained from oscilloscope recordings of velocities and pressure measured in the control and output channels of the bistable, following the application of a step signal in the control port. Tests were conducted for two different aspect ratios of the amplifier, and for control ports open and closed. The results are expected to prove useful for future comparisons with available theories of bistable switching, and for an experimental optimization of the bistable amplifier, made by taking into account not only its steady state but also its dynamic behaviour. Author (GRA)

N75-11223# Harry Diamond Labs., Washington, D.C.

AN EVALUATION OF EPOXY CASTING FOR THE SMALL SCALE PRODUCTION OF FLUERIC LOGIC DEVICES

Norman A. Eisenberg May 1974 16 p refs

(DA Proj. 1T1-61102-A-33B; HDL Proj. 302431)

(AD-784089; HDL-TM-73-39) Avail: NTIS CSCL 13/7

One hundred flueric triggers and their coverplates were cast in epoxy; the coverplates, which included integral tubing connectors, were glued to the triggers. These logic elements were then tested and the test results interpreted to judge the usefullness of the manufacturing technique for the small scale production of flueric logic elements. The tests measured output pressures and control switching pressures for various loading conditions. Large deviations exist between like measurements for different elements in the test group. Tests of elements that were bolted rather than glued indicate that the method of fastening the coverplate to the trigger caused some, but not all, of the deviation. The results of these tests show that the cast epoxy manufacturing process used for these triggers is not entirely satisfactory. Author (GRA)

N75-11224# Army Material Command, Texarkana, Tex. Intern Training Center.

THE DEVELOPMENT OF A FLUIDIC SIMULATION MODEL AS APPLIED TO PRODUCTION SYSTEMS Final Report

Harold L. Bowers Mar. 1973 100 p refs

(AD-784058; USAMC-ITC-2-73-004) Avail: NTIS CSCL 13/7

This project is concerned primarily with developing a fluidic simulation capable of modeling general production processes. By allowing the model to remain flexible enough to handle a broad spectrum of production applications, it is desired to apply some of the expertise of this fluidic technique in order to gain some insight into the complicated theory of modeling a production system. Author (GRA)

N75-11225# Army Foreign Science and Technology Center, Charlottesville, Va.

ANALYSIS AND INVESTIGATION OF FLUID ELEMENTS RELIABILITY

I. S. Mezin and A. N. Shubin 14 May 1974 15 p refs Transl. into ENGLISH from proceedings of the 4th Intern. Fluidics Conf. (Varna, Bulgaria), 14-18 Oct. 1972, Paper A-5

(AD-784331; FSTC-HT-23-1638-73) Avail: NTIS CSCL 13/7

Physical analysis and theoretical estimation of fluid elements reliability are considered. Statistical data on reliability of a fluid counter with turbulent logic elements is given that result from lengthy tests according to a specifically developed procedure. GRA

N75-11226# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.

AN INTERCELL HEAT PIPE FOR FUEL CELL AND BATTERY COOLING Final Report, Jun. 1972 - Jul. 1973

Dean L. Jacobson Dec. 1973 42 p refs

(Contract F30602-72-C-0418; AF Proj. 3145)

(AD-782888; AFAPL-TR-74-5) Avail: NTIS CSCL 10/2

A planar (rectangular cross section) heat pipe was designed to transfer 2000 watts at 115C plus or minus 12C. The evaporator area was fixed at 30.48cm by 12.7cm per side so that the design heat flux was 3.45 watts/sq cm. The heat pipe was tested with electrical heaters to simulate waste heat from two adjacent high power density fuel cell or battery modules. The device was constructed from two milled copper plates which were electron beam welded to produce the completed structure. The finished heat pipe thickness was 1.27cm. A single layer of 100 mesh copper screen covered rectangular milled capillary grooves. Triply distilled, deionized water was chosen as the working fluid. (Modified author abstract) GRA

N75-11227# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

TRANSONIC FLOW AT A SLOTTED TEST SECTION WALL Interim Report, 1 Oct. 1972 - 28 Feb. 1974

Sune B. Berndt and Hans Sorensen Apr. 1974 19 p refs

(Contract AF-AFOSR-2184-72; AF Proj. 9781)

(AD-784934; AFOSR-74-1423TR; IR-2; IR-3) Avail: NTIS CSCL 20/4

A brief preview is given of some important features of slot

flow as they are beginning to emerge from the present experimental and theoretical investigation. It is tentatively concluded, for a particular case typical of two-dimensional tests, that the slot flow is approximately inviscid (although influenced by boundary layer formation in the slot), that it leaves the slot as a free jet, that it is influenced by the test section wall boundary layer, and that the quadratic cross flow term in the pressure difference formula is important. Author (GRA)

N75-11228# Texas A&M Univ., College Station.
THE DEVELOPMENT OF NEW DIGITAL DATA PROCESSING TECHNIQUES FOR TURBULENCE MEASUREMENTS WITH A LASER VELOCIMETER Final Report, 1 Dec. 1972 - 1 Jan. 1974
W. T. Mayo, Jr., M. T. Shay, and S. Riter Aug. 1974 115 p refs
(Contract F40600-73-C-0003)
(AD-784891; AEDC-TR-74-53) Avail: NTIS CSCL 14/2

Research has developed a laser velocimeter data processing technique that may be used for on-line estimation of turbulence power spectra from randomly timed samples at low data rates. First, an estimate of the turbulence autocovariance is made at each lag by discretizing the time axis into lag units, accumulating the products of pairs of sample magnitudes occurring at each lag, and dividing the accumulated sums by the histogram of lag products. Then, the discrete Fourier transform of the turbulence autocovariance is computed, giving an estimate of the turbulence power spectra. (Modified author abstract) GRA

N75-11229# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
TURBULENCE MEASUREMENTS IN HYPERSONIC, HELIUM FLOW Interim Report
John B. Anders, Jr. Feb. 1974 98 p refs
(Contract F44620-71-C-0032; AF Proj. 9783)
(AD-784896; AMS-1157; AFOSR-74-1405TR) Avail: NTIS CSCL 20/4

Incompressible and compressible hot-wire theory is reviewed and many of the basic hot-wire equations are derived in detail. The instrumentation and probes used for measurements in a hypersonic boundary layer on the wall of a Mach 16 helium tunnel are described. Procedures for individual wire calibrations are outlined and typical results are presented. Data from measurements at the peak fluctuation point in the boundary layer are presented in terms of the rms mass flow and total temperature fluctuations. The data reduction problems encountered in compressible flow measurements are discussed, and the limitations of the hot-wire in hypersonic turbulent boundary layer measurements are pointed out. Author (GRA)

N75-11230# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL HYDRAULIC RAM STUDIES (FY 74) Final Report, 1 Jul. 1973 - 30 Jun. 1974
H. L. Power 1 Aug. 1974 70 p refs
(AD-784736; NPS-57PH74081) Avail: NTIS CSCL 01/3

The document is a report on the progress of FY74 experimental hydraulic ram studies. Penetration, shock, and drag phases of hydraulic ram were studied to understand this complicated phenomenon. Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N75-11231# Joint Publications Research Service, Arlington, Va.
GYROSCOPES
23 Oct. 1974 62 p refs Transl. into ENGLISH from various RUSSIAN journals
(JPRS-63272) Avail: NTIS HC $4.25

Several articles on gyroscopes including data on systematic drift, finite rotations and coordinate definition errors, movement in gimbal, elastic imbalance, spacecraft stabilization, static uniaxial gyrostabilizer, and frame inertia are reported. For individual titles, see N75-11232 through N75-11239.

N75-11232 Joint Publications Research Service, Arlington, Va.
SYSTEMATIC DRIFT OF A TRIAXIAL GYROSTABILIZER
T. K. Gadelshin *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 1-11 refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Mekh. Tverdogo Tela (USSR), no. 6, 1973 p 14-21 (For availability see N75-11231 02-35)

Systematic drift of triaxial gyrostabilizers as a function of the parameters of the gyrostabilizer and the external harmonic disturbing moments was evaluated. The effects of external harmonic perturbation on systematic drift was also considered. Author

N75-11233 Joint Publications Research Service, Arlington, Va.
EQUILIVALENT FINITE ROTATIONS AND ERRORS IN AUTONOMOUS COORDINATE DEFINITION
O. F. Boychuk *In its* Gyroscope (JPRS-63272) 23 Oct. 1974 p 12-20 refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 10, no. 2, 1974 p 94-100 (For availability see N75-11231 02-35)

Differential equations were used to discuss errors and finite rotation in coordinates found for the angular velocity of a horizontally stabilized platform moving on the terrestrial sphere. Author

N75-11234 Joint Publications Research Service, Arlington, Va.
A PARTIAL SOLUTION TO THE PROBLEM OF THE MOVEMENT OF A GYROSCOPE IN A GIMBAL
A. A. Bogoyavlenskiy *In its* Gyroscope (JPRS-63272) 23 Oct. 1974 p 21-25 refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Mekh. Tverdogo Tela (USSR), no. 2, 1974 p 27-29 (For availability see N75-11231 02-35)

The movement of a heavy gyroscope in a gymbal when the axis of rotation of the outer ring is horizontal was examined and a partial solution to the problem is presented. Author

N75-11235 Joint Publications Research Service, Arlington, Va.
PROBLEM OF MINIMIZING THE ABSOLUTE VALUE OF THE CENTRAL MOMENT OF ELASTIC IMBALANCE OF A GYROSCOPE
L. N. Blokhin *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 26-33 refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 10, no. 4, 1974 p 107-112 (For availability see N75-11231 02-35)

A study is made of the problem of the analytical design of the structure of a device which protects a gyroscope from the effects of vibrations of its base on which it is installed. Special attention was given to the construction of a vibration insulation system for the gyroscope. Author

N75-11236 Joint Publications Research Service, Arlington, Va.
PERIODIC MOVEMENTS OF A TRIAXIAL GYROSCOPIC SPACECRAFT STABILIZATION SYSTEM c18
V. V. Polyakov *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 34-42 refs Transl. into ENGLISH from Izv. Akad Nauk SSR, Mekh. Tverdogo Tela (USSR), no. 2, 1974 p 9-15 (For availability see N75-11231 02-35)

Periodic movements and the problem of angular stabilization of a spacecraft was studied. Gyroscopic devices were considered to function as servomechanisms in the system. Some consideration was also given to nonlinear problems of stabilization. E.H.W.

N75-11237 Joint Publications Research Service, Arlington, Va.
DRIFT OF A GYROSCOPE IN A GIMBAL ON A ROCKING BASE
D. M. Klimov and Yu. I. Rabinovich *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 43-46 refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Mekh. Tverdogo Tela (USSR), no. 2, 1974 p 58-59 (For availability see N75-11231 02-35)

A study is made of the movement of a gyroscope in a gimbal on a rocking base. The gyroscope is equipped with correction insuring perpendicularity of the gimbal axes; on the

outer ring of the gimbal an auxiliary gyroscope is installed. The drift rate of the gyroscope around the outer axis is determined. Author

N75-11238 Joint Publications Research Service, Arlington, Va.
SELECTION OF THE PARAMETERS OF A CORRECTING CIRCUIT FOR A STATIC UNIAXIAL GYROSTABILIZER
Ye. Ye. Golovkin *In its* Gyroscopes (JPRS-63272) 23 Oct. 1974 p 47-52 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 2, 1974 p 77-81 (For availability see N75-11231 02-35)

A study was made of the problem of synthesizing the parameters of a uniaxial gyroscopic stabilization system for a given structure of the stabilizer. Author

N75-11239 Joint Publications Research Service, Arlington, Va.
COEFFICIENTS OF EFFECT OF THE FRAME INERTIA ON THE GYROSCOPE ERRORS IN THE PRESENCE OF UNIFORM ROTATION OF THE BASE
Kh. L. Smolitskiy *In its* Gyroscope (JPRS-63272) 23 Oct. 1974 p 53-59 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (USSR), no. 1, 1974 p 83-88 (For availability see N75-11231 02-35)

Tables are proposed for approximate calculations of the deflections of the gyroscope axis during the time of one complete rotation of a uniformly rotating base. Examples of using the tables are given. Author

N75-11240# Joint Publications Research Service, Arlington, Va.
GUIDANCE TECHNOLOGY
31 Oct. 1974 39 p refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 62-99 (JPRS-63339) Avail: NTIS HC $3.75

Data are presented on Houve gyroscope, gyro orbits with discontinuous control, navigation system in single star mode, discontinuity effects in feed voltage of gyromotors, stabilization systems for pulsed signal storage, and increased sensitivity of photoelement with current generators. For individual titles, see N75-11241 through N75-11247.

N75-11241 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE ROTATION RATE OF THE ROTOR ON THE ANGULAR RIGIDITY OF THE ELASTIC SUSPENSION OF A HOUVE GYROSCOPE
M. V. Polymskikh *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 1-4 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 62-64 (For availability see N75-11240 02-35)

The divergence in the angular rigidity of the torsions of an operating and stationary Houve gyroscope is noted. A formula is presented for determining this divergence as applied to thin-walled torsions of cruciform cross section. Author

N75-11242 Joint Publications Research Service, Arlington, Va.
GYRO ORBIT WITH DISCONTINUOUS CONTROL LAW
A. N. Gerasimov, N. V. Azarov, and G. S. Melyanovskaya *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 5-10 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 64-68 (For availability see N75-11240 02-35)

Onboard digital computers were used to control the gyro orbits with discontinuous or discontinuous-step characteristics of the output converters. Within precession theory, differential equations of motion of gyro orbit with respect to bank and yaw were written. Formulas were derived for calculating the auto-oscillation parameters. J.A.M.

N75-11243 Joint Publications Research Service, Arlington, Va.
NAVIGATION SYSTEM IN THE SINGLE STAR ASTROCORRECTION MODE **c04**
M. A. Sergeyev and V. I. Yushchenko *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 11-16 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 68-73 (For availability see N75-11240 02-35)

The navigation system includes a measuring section and a coding and recording device onboard aircraft, as well as a digital computer. This computer is used for post flight processing of measurements. The measuring system is described for determining the coordinates of the object and for tracking the star. J.A.M.

N75-11244 Joint Publications Research Service, Arlington, Va.
EFFECT OF A DISCONTINUITY IN THE FEED VOLTAGE ON THE AXIAL AND RADIAL VIBRATION OF GYROMOTORS WITH AERODYNAMIC SUPPORTS
I. A. Baranov, Ye. B. Zaychenkova, Ye. P. Sevodin, and I. V. Yakovlev *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 17-19 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 73-74 (For availability see N75-11240 02-35)

Constant and variable forces were found to act on the gyromotor's rotor. These variables included rotor weight, rotor imbalance, and electromagnetic forces. Discontinuity in the feed foltage resulted in amplitude changes. Vibrational and rigidity characteristics and center of mass were found to vary from start to start. J.A.M.

N75-11245 Joint Publications Research Service, Arlington, Va.
ACCELEROMETER WITH FORCED ROTATION
A. M. Lestev and V. V. Nikulicheva *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 20-25 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 75-79 (For availability see N75-11240 02-35)

The method of error compensation was studied for zero shift of a pendulum compensation accelerometer by reducing the moving part to uniform rotation around the axis of sensitivity. Formulas were obtained for the accelerometer errors caused by harmonic and random oscillations of the base. Author

N75-11246 Joint Publications Research Service, Arlington, Va.
STABILIZATION SYSTEMS FOR PULSED SIGNAL STORAGE ELEMENTS
A. G. Ryndyk *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 26-30 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 88-91 (For availability see N75-11240 02-35)

Stabilization systems were studied in storage elements with delay feedback operating in a separate frequency channel. The formulas are presented for determining the stationary regime parameters and the stability conditions. Author

N75-11247 Joint Publications Research Service, Arlington, Va.
INCREASING THE SENSITIVITY OF A PHOTOELEMENT IN SYSTEMS WITH CURRENT GENERATORS
A. Kh. Agranov and L. F. Porfiryev *In its* Guidance Technol. (JPRS-63339) 31 Oct. 1974 p 31-36 refs Transl. into ENGLISH from Priborostroyeniye (Moscow), no. 6, 1974 p 95-99 (For availability see N75-11240 02-35)

Basic relations are derived to establish the gain in sensitivity and in the signal/noise ratio at the output of the photoelement. This occurs when feeding a generator current. Analogous characteristics are compared in systems with the power supply from EMF generators. Author

N75-11248*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ULTRASONIC CALIBRATION DEVICE **Patent Application**
Joseph S. Heyman and James G. Miller, inventors (to NASA) (Washington Univ.) Filed 11 Nov. 1974 10 p (NASA-Case-LAR-11435-1; US-Patent-Appl-SN-522556) Avail: NTIS HC $3.25 CSCL 14B

An ultrasonic calibration device for producing known changes in both acoustic absorption and phase velocity is reported. The calibration signal arises from an actual change of acoustic parameters, not from an electrical simulation. Thus, changes in ultrasonic time domain decay rates and frequency domain line widths are produced. Therefore, the device is able to simulate not only changes in ultrasonic absorption and phase velocity but also the sensitivity enhancement achieved by the use of ultrasonic resonators. The latter simulation cannot be achieved using electrical calibration techniques. NASA

N75-11249*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE FOURTH PRECISE TIME AND TIME INTERVAL PLANNING MEETING

H. N. Acrivos, comp. and Clark Wardrip, comp. 16 Nov. 1972 381 p refs Meeting held at Greenbelt, Md., 14-16 Nov. 1972; sponsored by Naval Obs., and Naval Electron. Systems Command
(NASA-TM-X-70772; X-814-73-72) Avail: NTIS HC $10.25
CSCL 14B

The proceedings of a conference on Precise Time and Time Interval Planning are presented. The subjects discussed include the following: (1) satellite timing techniques, precision frequency sources, and very long baseline interferometry, (2) frequency stabilities and communications, and (3) very low frequency and ultrahigh frequency propagation and use. Emphasis is placed on the accuracy of time discrimination obtained with time measuring equipment and specific applications of time measurement to military operations and civilian research projects. For individual titles, see N75-11250 through N75-11274.

N75-11250* Naval Research Lab., Washington, D.C.
TIMATION 3 SATELLITE **c15**
Charles A. Bartholomew *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 7-13 (For availability see N75-11249 02-35)
CSCL 22B

The characteristics of the Timation 3 satellite are discussed. A diagram of the basic structure is provide to show the solar panels, navigation and telemetry antennas, gravity gradient booms, and solar cell experiments. The specific application of the satellite for time management or time transfer for navigation purposes is reported. Various measurements and experiments conducted by the satellite are described. Author

N75-11251* Naval Research Lab., Washington, D.C.
BRITISH AMERICAN SATELLITE TIME TRANSFER EXPERIMENT
Roger Easton *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 14-28 (For availability see N75-11249 02-35)
CSCL 14B

The use of the Timation satellite for navigation purposes is discussed. The advantages of the satellite for navigation and time transfer are defined as: (1) well-known position, (2) line-of-sight signal which allows use of ultrahigh frequency signals, (3) worldwide coverage, and (4) celestial navigation solution similar to the conventional celestial navigation practices. A diagram of range measurement by phase measure is provided. The application of an intercept chart for determining position using the navigation satellite is demonstrated. The results of a ground based time transfer experiment are reported. Author

N75-11252* Maryland Univ., College Park. Dept. of Physics and Astronomy.
PERFORMANCE OF THE NEW EFRATOM OPTICALLY PUMPED RUBIDIUM FREQUENCY STANDARDS AND THEIR POSSIBLE APPLICATION IN SPACE RELATIVITY EXPERIMENTS
Carroll O. Alley, Ralph Williams, Gurbax Singh, and John Mullendore *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 29-40 refs (For availability see N75-11249 02-35)
CSCL 14B

The characteristics of Efratom optically pumped rubidium frequency standards are discussed. The Efratom units were compared with cesium beam and hydrogen maser standards and showed a stability of approximately 5 times 10 to the minus 12th power over two one-week periods. Dependency of frequency upon the environmental parameters of pressure, magnetic field, temperature, supply voltage, and acceleration was measured. A package of three units with automatic phase comparison and recording was designed and constructed to allow a measurement of relativistic effects on time with high accuracy during space missions. Author

N75-11253* Maryland Univ., College Park. Dept. of Physics and Astronomy.
SECOND GENERATION TIMING SYSTEM FOR RANGING EXPERIMENT APOLLO LUNAR LASER **c36**
Douglas G. Currie, Charles Steggerda, John Rayner, and Albert Buennagel *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 41-45 (For availability see N75-11249 02-35)
(Grant NGR-21-002-267)
CSCL 20E

The status of the timing electronics for the lunar laser ranging station in Hawaii is discussed. The aim of the experiment is to measure, with high accuracy, the distance from a fixed point on earth to a retroreflector array which was placed on the lunar surface. The operating procedure for conducting the experiment is described. The components of the system are analyzed to show the effectiveness and accuracy of the facility. Author

N75-11254* Frequency and Time Systems, Inc., Danvers, Mass.
PRECISION FREQUENCY SOURCES
Arthur O. McCoubrey and Robert H. Kern *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1962 p 46-54 ref (For availability see N75-11249 02-35)
CSCL 14B

The development of precision oscillators for time and frequency standards is discussed. The applications of the oscillators to radio communication, research projects, navigation systems, and calibration sources are reported. The status of a cesium beam stabilized oscillator is examined. Photographs of the components are provided. The performance of quartz and rubidium oscillators is compared with the performance of cesium resonators. Author

N75-11255* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA HYDROGEN MASER ACCURACY AND STABILITY IN RELATION TO WORLD STANDARDS **c36**
Harry E. Peters and Donald B. Percival (Naval Obs.) *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 55-61 refs (For availability see N75-11249 02-35)
CSCL 20E

Frequency comparisons were made among five NASA hydrogen masers to a precision of one part in 10 to the 13th power. Frequency comparisons were also made between these masers and the cesium-beam ensembles of several international standards laboratories. The hydrogen maser frequency stabilities as related to the international time scale (IAT) were comparable to the frequency stabilities of individual time scales with respect to IAT. The relative frequency variations among the NASA masers were 2 plus or minus 2 parts in 10 to the 13th power after a three year interval. Charts are developed to show the results of the accuracy tests. Author

N75-11256* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERY LONG BASELINE INTERFEROMETRY (VLBI) EARTH PHYSICS **c42**
Peter F. MacDoran *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 17 Nov. 1972 p 62-73 refs (For availability see N75-11249 02-35)
(Contract NAS7-100)
CSCL 08E

The characteristics of the Michelson/Pease stellar interferometer are discussed. An analog of the interferometer using radio waves is described. The use of a conventional hard-wired interferometer with very long base line interferometry (VLBI) is analyzed. Mathematical models are developed to analyze the VLBI techniques. A summary of VLBI geodetic experiments is tabulated. The concept and application of the astronomical radio interferometric earth surveys (ARIES) are reported. A schematic diagram of ARIES implementation is provided. Author

N75-11257* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECISION TIMING AND VERY LONG BASELINE INTERFEROMETRY (VLBI)
Thomas A. Clark *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 74-89 refs (For availability see N75-11249 02-35)
CSCL 14B

The use of very long baseline interferometry (VLBI) for investigating small angular features in galactic and extragalactic

radio sources is discussed. Mathematical models are developed to describe the operation of an interferometer and to show the variations in the resultant fringe frequency. The types of sources to which the interferometer will respond are identified. Author

N75-11258* Bendix Field Engineering Corp., Greenbelt, Md.
TRACKING THE LUNAR ROVER VEHICLE WITH VERY LONG BASELINE INTERFEROMETRY TECHNIQUES c32
Daniel Shnidman *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 90-99 refs (For availability see N75-11249 02-35)
CSCL 17B

The principles of operation of Very Long Baseline Interferometry (VLBI) are discussed. The application of VLBI techniques for tracking lunar rover vehicles during the Apollo 16 and 17 missions is reported. A map of the Apollo 16 lunar rover track is provided. Charts are developed to show the incremental motion of the lunar vehicle during the mission. Author

N75-11259* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYSIS AND DEMONSTRATION OF CLOCK SYNCHRONIZATION BY VLBI
William J. Hurd *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 100-122 refs (For availability see N75-11249 02-35)
CSCL 14B

A prototype of a semireal-time system for synchronizing the DSN station clocks by radio interferometry was successfully demonstrated. The system utilized an approximate maximum likelihood estimation procedure for processing the data, thereby achieving essentially optimum time synchronization estimates for a given amount of data, or equivalently, minimizing the amount of data required for reliable estimation. Synchronization accuracies as good as 100 nsec rms were achieved between DSS 11 and DSS 12, both at Goldstone, California. The accuracy can be improved by increasing the system bandwidth until the fundamental limitations due to position uncertainties of baseline and source and atmospheric effects are reached. These limitations are under ten nsec for transcontinental baselines. Author

N75-11260* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME AND FREQUENCY REQUIREMENT FOR THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM c42
Friedrich O. VonBun *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 123-131 (For availability see N75-11249 02-35)
CSCL 08E

The application of time and frequency standards to the Earth and Ocean Physics Applications Program (EOPAP) is discussed. The goals and experiments of the EOPAP are described. Methods for obtaining frequency stability and time synchronization are analyzed. The orbits, trajectories, and characteristics of the satellites used in the program are reported. Author

N75-11261* Naval Observatory, Washington, D.C.
INTERMEDIATE TERM FREQUENCY MEASUREMENTS WITH THE HP COMPUTING COUNTER IN THE USNO CLOCK TIME SYSTEM
Gernot M. R. Winkler *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 152-167 refs (For availability see N75-11249 02-35)
CSCL 14B

High precision frequency measurements with various integration times can be made with conventional counters by using variable gate times. The Hewlett-Packard (HP) computing counter allows such measurements over a wide range of frequencies and measurement times. This instrument can also convert period measurements into frequency by means of its arithmetic capabilities: The program library contains programs to facilitate frequency stability measurements in the most direct and convenient way. This method was used as the basis for all time scale computations, until requirements for highest resolution justified the development of an automatic data acquisition system. The phase measurements are now being made with the HP computing counter (with time interval plug-in unit) under program control from the HP System Programmer. Author

N75-11262* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPERATIONAL STABILITY OF RUBIDIUM AND CESIUM FREQUENCY STANDARDS
John E. Lavery *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 168-181 refs (For availability see N75-11249 02-35)
CSCL 14B

In the course of testing various rubidium and cesium frequency standards under operational conditions for use in NASA tracking stations, about 55 unit-years of relative frequency measurements for averaging times from 10 to 10 to the 7th power have been accumulated at Goddard Space Flight Center (GSFC). Statistics on the behavior of rubidium and cesium standards under controlled laboratory conditions have been published, but it was not known to what extent the lesser controlled environments of NASA tracking stations affected the performance of the standards. The purpose of this report is to present estimates of the frequency stability of rubidium and cesium frequency standards under operational conditions based on the data accumulated at GSFC. Author

N75-11263* Naval Research Lab., Washington, D.C.
HAWAII PTTI TEST BED
James A. Murray *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 182-193 (For availability see N75-11249 02-35)
CSCL 14B

The development and installation of a test bed for a Precise Time and Time Interval (PTTI). A prime goal in the effort is to develop a repertoire of techniques and equipment that will permit communications facilities to be served most effectively by their ties to a common time reference. The test bed provides guidance for the implementation of precise time and frequency discipline at other facilities. One product of the test-bed problem is an assessment of the accuracy of the time-discipline chain from the observatory to each level of use. Author

N75-11264* National Communications System, Arlington, Va.
TIME AND FREQUENCY FOR DIGITAL TELECOMMUNICATIONS c32
Harold C. Folts *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 194-202 refs (For availability see N75-11249 02-35)
CSCL 17B

Time and frequency (T and F) are fundamental and pervasive parameters of telecommunication technology. Advancing development of digital communications using data modulation rates above 2400 baud and time-division multiplex in complex network configurations is now requiring more accurate and precise T and F reference information for efficient operation of telecommunication systems. A schematic diagram of a general communication system is shown. This diagram is very general and can depict any type of communication. The information source selects a specific message which is encoded and sent through a communication channel. Enroute, the signal is subjected to perturbations from environmental noise. The received signal is then decoded and delivered to its destination. Through the process, the message may undergo many spurious changes, resulting in a loss of information content in the delivered message as compared to the original selected message. In digital telecommunication systems, loss of information content of the signals can be attributed to noise, distortion of waveshape, and loss of synchronization. Author

N75-11265* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRECISION TIME DISTRIBUTION WITHIN A DEEP SPACE COMMUNICATIONS COMPLEX c17
Jay B. Curtright *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 203-212 refs (For availability see N75-11249 02-35)

CSCL 17B

The Precision Time Distribution System (PTDS) at the Golstone Deep Space Communications Complex is a practical application of existing technology to the solution of a local problem. The problem was to synchronize four station timing systems to a master source with a relative accuracy consistently and significantly better than 10 microseconds. The solution involved combining a precision timing source, an automatic error detection assembly and a microwave distribution network into an operational system. Upon activation of the completed PTDS two years ago, synchronization accuracy at Goldstone (two station relative) was improved by an order of magnitude. It is felt that the validation of the PTDS mechanization is now completed. Other facilities which have site dispersion and synchronization accuracy requirements similar to Goldstone may find the PTDS mechanization useful in solving their problem. At present, the two station relative synchronization accuracy at Goldstone is better than one microsecond. Author

N75-11266* Naval Research Lab., Washington, D.C.
UTILIZATION OF FSK COMMUNICATIONS FOR TIME c32

Robert R. Stone, Jr., Thomas H. Gattis, and Theodore N. Lieberman (Naval Electron. Systems Command) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 213-224 (For availability see N75-11249 02-35)

CSCL 17B

The method of time control at a radio station for time signal transmission using frequency shift keying, is discussed. Methods for extracting a recovered clock at the receiver are described. Results of a test involving the methods of processing time signals are presented. The requirements for adapting Precise Time and Time Interval control to a communications system are analyzed. A method for reducing the time required for synchronization or identification of messages and the fallout from the communication system to passive timekeeping users are reported. Author

N75-11267* Naval Electronic Systems Command, Washington, D.C.
TIMING REQUIREMENTS FOR THE SANGUINE ELF COMMUNICATIONS SYSTEM c32

Bodo Kruger *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 225-231 refs (For availability see N75-11249 02-35)

CSCL 17B

The development of an extremely low frequency (ELF) communications system for command and control of naval forces is discussed. The basic requirements for the system are defined. Emphasis is placed on the clock requirements based on phase or time rather than frequency. The time and frequency requirements at the transmitter stations are tabulated. Author

N75-11268* Naval Electronics Lab. Center, San Diego, Calif.
CALIBRATED VLF PHASE MEASUREMENTS: SIMULTANEOUS REMOTE AND LOCAL MEASUREMENTS OF 10.2kHz CARRIER PHASE USING CESIUM STANDARDS c32

Eric R. Swanson, Richard H. Gimber, and James E. Britt *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 232-248 ref (For availability see N75-11249 02-35)

CSCL 17B

An investigation of spatial irregularity of VLF phase due to nearby objects and terrain is discussed. It is shown that the phase is regular to the microsecond accuracy of the instrumentation, and that a grounded steel tower in close proximity to a whip antenna will not affect the phase measurement. However, antennas coupling to trees may cause an anomalous phase shift. Author

N75-11269* National Bureau of Standards, Washington, D.C.
THE USES AND LIMITATIONS OF HF STANDARD BROADCASTS FOR TIME AND FREQUENCY COMPARISON c32

John T. Stanley *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1974 p 249-258 refs (For availability see N75-11249 02-35)

CSCL 17B

The most practical methods of using high-frequency (HF) broadcasts for frequency and time comparison are reviewed. Although standard broadcast and receiving equipment has improved vastly throughout the past fifty years, the HF propagation medium is no more stable today than it was a half century ago. Doppler shift resulting from changes in the effective height of the ionosphere typically limits the usable accuracy of received high frequencies to a few parts in 10 to the 7th power. At locations beyond groundwave range of the transmitter, uncertainties in path delay generally restrict the usable accuracy of HF time signals to the order of a millisecond. Signal-averaging techniques are sometimes employed to extract frequency or time signals from a noisy background. Author

N75-11270* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLOBAL RESCUE ALARM NET (GRAN) EXPERIMENT c04

James C. Morakis *In* Its Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 259-266 (For availability see N75-11249 02-35)

CSCL 17G

The OMEGA Position Location Experiment (OPLE) was performed in 1967 by the Goddard Space Flight Center in order to demonstrate a position location and data collection system. OMEGA navigation signals were received at a remote site and retransmitted via a synchronous satellite to a ground processing center where data collecting and position determination were performed. Recent technological advances have made it possible to develop an Advanced OPLE System towards a global search and rescue application. This application generated some new problem areas such as the OMEGA lane ambiguity, random access, location accuracy, real-time processing, and size and weight of the Search and Rescue Communications (SARCOM). This experiment demonstrates the feasibility of instantaneous alarm and position location by using a relatively inexpensive, battery operated, three-pound package. Author

N75-11271* Corps of Engineersk Fort Belvoir, Va.
DELAY TIME MEASUREMENTS OF THE PROPAGATION OF RADIO WAVES IN THE ATMOSPHERE c32

Frederick Rohde *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 285-309 (For availability see N75-11249 02-35)

CSCL 20N

The characteristics and operation of the Geodetic Secor System are described. The precision of the ionospheric radiation measurements was determined by a collocation experiment. The EGRS-13 satellite, which was used in the experiment, is discussed. The geodetic network is shown in a diagram form. Conclusions resulting from the experiments are reported. Author

N75-11272* Naval Electronics Lab. Center, San Diego, Calif.
USE OF PROPAGATION CORRECTIONS FOR VLF TIMING

Eric R. Swanson *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 310-323 refs (For availability see N75-11249 02-35)

CSCL 20N

The theory of VLF timing from phase measurements is briefly reviewed with attention to both frequency and epoch. Propagational aspects are noted without specific attention to predictional details. Cycle slippage is described. Application of propagation corrections to VLF timing is described, with particular attention to the use of available skywave corrections published for the OMEGA Navigation System. Author

N75-11273* Army Electronics Technology and Devices Lab., Fort Monmouth, N.J.
INTERPRETATION OF VLF PHASE DATA c32

Friedrich Reder, James Hargrave, and James Crouchley (Queensland Univ.) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 324-344 refs (For availability see N75-11249 02-35)

CSCL 20N

The specific applications of very low frequency phase tracking are described. The requirements for correct interpretation of very low frequency phase data are defined. The effects of the lower ionosphere and the ground along the path of signal propagation are analyzed. The following subjects are discussed: (1) interpretation equipment, (2) representation of very low frequency waves, (3) diurnal effects and mode interference phenomena, (4) antipodal interference, and (5) overall effects resulting from solar flares, galactic X-rays, and geomagnetic parameters. Author

N75-11274* Naval Electronics Lab. Center, San Diego, Calif.
OMEGA TIMING RECEIVER, DESIGN AND SYSTEM TEST c04

John J. Wilson, James E. Britt, and Andrew Chi (NASA. Goddard Space Flight Center) *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 345-361 refs (For availability see N75-11249 02-35)

CSCL 17G

The design of a two frequency OMEGA Timing Receiver is discussed. The receiver tracks the arrival time of the signals by precise phase matching at the receiving antenna. Provision is made for inserting a propagation delay correction for each signal path. Time is measured as the difference between the zero crossing coincidence of the corrected signals and the local time. This number is displayed on the front panel in microseconds. The receiver can also function as a precise phase tracking receiver for collection of propagation data essential to augmenting the propagation corrections. All phase and time information is made available in a BCD format for flexibility in interfacing with other equipment. Results of preliminary tests using experimental transmissions are given. Preliminary results indicate time may be transferred by this technique to an accuracy of a few microseconds. Author

N75-11275*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE FIFTH ANNUAL NASA AND DEPARTMENT OF DEFENSE PRECISE TIME AND TIME INTERVAL PLANNING MEETING

1973 457 p refs Proc. held at Greenbelt, Md., 4-5 Dec. 1973; sponsored by Naval Electronic Systems Command and Naval Obs.

(NASA-TM-X-70773; X-814-74-225) Avail: NTIS HC $11.50

CSCL 14B

Subjects covered at this meeting were navigation, communications, applications of interferometry, frequency and time standards and synchronization, and radio wave propagation. For individual titles, see N75-11276 through N75-11303.

N75-11276* Defense Mapping Agency Topographic Center, Washington, D.C.
DMA PRECISE TIME AND TIME INTERVAL REQUIREMENTS

R. H. Carnahan *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 1-13 (For availability see N75-11275 02-35)

CSCL 14B

Defense Mapping Agency timing requirements ranging from milliseconds to tenths of nanoseconds and its use of geodetic astronomy and satellite geodesy programs are discussed in detail. Author

N75-11277* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME FREQUENCY REQUIREMENTS FOR RADIO INTERFEROMETRIC EARTH PHYSICS c42

J. B. Thomas and Henry F. Fliegel *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 15-31 (For availability see N75-11275 02-35)

CSCL 08E

Two systems of VLBI (Very Long Baseline Interferometry) are now applicable to earth physics: an intercontinental baseline system using antennas of the NASA Deep Space Network, now observing at one-month intervals to determine UTI for spacecraft navigation; and a shorter baseline system called ARIES (Astronomical Radio Interferometric Earth Surveying), to be used to measure crustal movement in California for earthquake hazards estimation. On the basis of experience with the existing DSN system, a careful study has been made to estimate the time and frequency requirements of both the improved intercontinental system and of ARIES. Requirements for the two systems are compared and contrasted. Author

N75-11278* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME, GEODESY, AND ASTROMETRY: RESULTS FROM RADIO INTERFEROMETRY

Thomas A. Clark and Irwin I. Shapiro (MIT) *In its* Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 33-46 (For availability see N75-11275 02-35)

CSCL 14B

The results from a total of a dozen transcontinental and intercontinental VLBI experiments are discussed. Particular emphasis is placed on: (1) the inferred behavior of the frequency standards, usually hydrogen masers, on time scales from 10 to 100,000 seconds; (2) the estimated celestial positions of the observed radio sources; (3) the determinations of the vector baselines; and (4) the inferred values of polar motion and UT.1. Author

N75-11279* Naval Research Lab., Washington, D.C.
APPLICATIONS OF RADIO INTERFEROMETRY TO NAVIGATION c04

S. H. Knowles, Kenneth J. Johnston, and E. O. Hulburt *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 47-58 (For availability see N75-11275 02-35)

CSCL 17G

Radio astronomy experiments have demonstrated the feasibility of making precise position measurements using interferometry techniques. The application of this method to navigation and marine geodesy is discussed, and comparisons are made with existing navigation systems. The very long baseline technique, with a master station, can use either an artificial satellite or natural sources as position references; a high-speed data link is required. A completely ship-borne system is shown to be feasible, at the cost of poorer sensitivity for natural sources. A comparison of Doppler, delay and phase-track modes of operating a very long baseline configuration is made, as that between instantaneous measurements and those where a source can be tracked from horizon to transit. Geometric limitations in latitude and longitude coverage are discussed. The characteristics of natural radio sources, their flux, distribution on the sky, and apparent size are shown to provide a limit on position measurements precision. The atmosphere and frequency standard used both contribute to position measurement uncertainty by affecting interferometric phase. Author

N75-11280* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEMONSTRATION OF INTERCONTINENTAL DSN CLOCK SYNCHRONIZATION BY VLBI

William J. Hurd *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 59-73 (For availability see N75-11275 02-35)

CSCL 14B

The prototype system for Deep Space Network clock synchronization by VLBI has been demonstrated to operate successfully over intercontinental baselines in a series of experiments between Deep Space Stations at Madrid, Spain, and Goldstone, California. As predicted by analysis and short baseline demonstration, the system achieves reliable synchronization between 26m and 64m antenna stations with 17 and 37K nominal system temperatures using under one million bits of data from each station. Semi-real-time operation is feasible since this small amount of data can be transmitted to JPL and processed within minutes. The system resolution is 50 to 400ns, depending on the amount of data processed and the source intensity. The accuracy is believed to be comparable to the resolution, although it could be independently confirmed to only about 5 microseconds using LORAN C. Author

N75-11281* Defense Mapping Agency Topographic Center, Washington, D.C.
THE AUTOMATED ASTRONOMIC POSITIONING SYSTEM (AAPS) c89
Owen N. Williams *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 75-93 (For availability see N75-11275 02-35)
CSCL 03A

Two prototype systems of The Automated Astronomic Positioning System (AAPS) have been delivered to Defense Mapping Agency (DMA). The AAPS was developed to automate and expedite the determination of astronomic positions (latitude and longitude). This equipment is capable of defining astronomic positions to an accuracy sigma = 0.3 in each component within a two hour span of stellar observations which are acquired automatically. The basic concept acquires observations by timing stellar images as they cross a series of slits, comparing these observations to a stored star catalogue, and automatically deducing position and accuracy by least squares using pre-set convergence criteria. An exhaustive DMA operational test program has been initiated to evaluate the capabilities of the AAPS in a variety of environments (both climatic and positional). Status of the operational test is discussed. Author

N75-11282* Newark Air Force Station, N.J.
LOW COST AUTOMATED PRECISE TIME MEASUREMENT SYSTEM
A. Alpert and P. Liposchak *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 95-105 (For availability see N75-11275 02-35)
CSCL 14B

The Aerospace Guidance and Metrology Center (AGMC) has the responsibility for the dissemination of Precise Time and Time Interval (PTTI) to Air Force timing systems requiring microsecond time. In order to maintain traceability to the USNO Master Clock in Washington D.C., and accomplish efficient logging of time ahp frequency data on individual precision clocks, a simple automatic means of acquiring precise time has been devised. The Automatic Time Interval Measurement System (ATIMS) consists of a minicomputer (8K Memory), teletype terminal, electronic counter, Loran C receiver, time base generator and locally-manufactured relay matrix panel. During the measurement process, the computer controls the relay matrix which selects for comparison 13 atomic clocks against a reference clock and the reference versus Loran C. Through use of the system teletype, the operator is able to set the system clock (hours, minutes and seconds), examine and/or modify all clock data and constants, and set measurement intervals. This is done in a conversational manner. A logic flow diagram, system schematic, source listing and software components are included in the presentation.
Author

N75-11283* ITT Federal Electric Corp., Vandenberg AFB, Calif.
PRECISE TIMING CORRELATION IN TELEMETRY RECORDING AND PROCESSING SYSTEMS c17
Robert B. Pickett and Frank L. Matthews *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 107-125 refs (For availability see N75-11275 02-35)
CSCL 09F

Independent PCM telemetry data signals received from missiles must be correlated to within + or - 100 microseconds for comparison with radar data. Tests have been conducted to determine RF antenna receiving system delays; delays associated with wideband analog tape recorders used in the recording, dubbing and repdocuing processes; and uncertainties associated with computer processed time tag data. Several methods used in the recording of timing are evaluated. Through the application of a special time tagging technique, the cumulative timing bias from all sources is determined and the bias removed from final data. Conclusions show that relative time differences in receiving, recording, playback and processing of two telemetry links can be accomplished with a + or - 4 microseconds accuracy. In addition, the absolute time tag error (with respect to UTC) can be reduced to less than 15 microseconds. This investigation is believed to be the first attempt to identify the individual error contributions within the telemetry system and to describe the methods of error reduction within the telemetry system and to describe the methods of error reduction and correction. Author

N75-11284* Naval Research Lab., Washington, D.C.
DIGITAL FREQUENCY CONTROL OF SATELLITE FREQUENCY STANDARDS c33
Stephen A. Nichols *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 127-145 refs (For availability see N75-11275 02-35)
CSCL 09E

In the Frequency and Time Standard Development Program of the TIMATION System, a new miniaturized rubidium vapor frequency standard has been tested and analyzed for possible use on the TIMATION 3A launch, as part of the Defense Navigation Satellite Development Program. The design and construction of a digital frequency control was required to remotely control this rubidium vapor frequency standard as well as the quartz oscillator in current use. This control must be capable of accepting commands from a satellite telemetry system, verify that the correct commands have been sent and control the frequency to the requirements of the system. Several modifications must be performed to the rubidium vapor frequency standard to allow it to be compatible with the digital frequency control. These include the addition of a varactor to voltage tune the coarse range of the flywheel oscillator, and a modification to supply the C field current externally. The digital frequency control for the rubidium vapor frequency standard has been successfully tested in prototype form. Author

N75-11285* Royal Greenwich Observatory, Herstmonceux (England).
FACILITIES AND SERVICES IN THE TIME DEPARTMENT OF THE ROYAL GREENWICH OBSERVATORY
H. M. Smith *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 147-155 refs (For availability see N75-11275 02-35)
CSCL 14B

The history, equipment, and current work of the Royal Greenwich Observatory are briefly reviewed. A.L.

N75-11286* National Bureau of Standards, Boulder, Colo.
SOME SERVICES OF THE TIME AND FREQUENCY DIVISION OF THE NATIONAL BUREAU OF STANDARDS
James A. Barnes *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 159-161 (For availability see N75-11275 02-35)
CSCL 14B

The Time and Frequency Division of the National Bureau of Standards (NBS) provides several services to the general public. The radio broadcasts of WWV, WWVH, and WWVB supply reliable, unambiguous time signals to many users. The NBS telephone time-of-day service attracts several hundreds of thousands of calls each year. Periodically, the NBS provides courses on specific topics relating to time and frequency technology. In addition to numerous technical papers published each year, the NBS has prepared the first volume of a comprehensive monograph on time and frequency. The results of research in the Time and Frequency Division of the NBS have had significant impact. An active TV time system capable of serving most of the U.S. currently awaits a ruling by the FCC on a petition filed last year on behalf of the NBS by the Department of Commerce. Three more recent developments are: (1) a TV frequency comparator (patent applied for); (2) a method to perform an independent (absolute) frequency evaluation of commercial cesium beam oscillators; and (3) a method of removing one source of frequency drift in commercial cesium beam oscillators. Author

N75-11287* Naval Research Lab., Washington, D.C.
SUBMICROSECOND TIME TRANSFER BETWEEN THE UNITED STATES, UNITED KINGDOM, AND AUSTRALIA VIA SATELLITE
Roger L. Easton, H. M. Smith (Royal Greenwich Obs.), and P. Morgan (Australian Div. of Natl. Mapping) *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD

Precise Time and Time Interval Planning Meeting 1973 p 163-183 (For availability see N75-11275 02-35)
CSCL 14B

During 1972 time transfer experiments were run between the U.S. Naval Observatory and the Royal Greenwich Observatory and, in 1973, between the U.S. Naval Observatory and the Division of National Mapping in Canberra, Australia. In both cases the time transfer agent was the TIMATION 2 satellite, 1969-82B. The satellite ephemerides were computed from data provided by the Defense Mapping Agency TRANET. This net tracked the satellite's Doppler transmissions. The phase of the satellite clock was determined from knowledge of the position of the satellite and of the observer and the computed distance between the two. By monitoring the clock on successive passes the rate of the satellite clock was determined at Washington. By again monitoring the satellite clock at the distant station the satellite clock could be compared to the local clock and this local clock compared to the U.S. Naval Observatory clocks. In 1972 the RMS of observations at Greenwich deviated by approximately 1/4 microsecond from a straight line when compared to the Naval Observatory. In 1973 the observation errors at Canberra were approximately half as great. Author

N75-11288* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
INSTRUMENTATION FOR ONE-WAY SATELLITE PTTI APPLICATIONS
A. E. Osborne *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 185-213 refs (For availability see N75-11275 02-35)
(Contract N00017-72-C-4401)
CSCL 14B

A review of general principles and operational procedures illustrates how the typical passive user and omni receiving antenna can recover Precise Time and Time Interval (PTTI) information from a low altitude navigation satellite system for clock calibration and synchronization. Detailed discussions of concepts and theory of the receiver design are presented. The importance of RF correlation of the received and local PN encoded sequences is emphasized as a means of reducing delay uncertainties of the instrumentation to values compatible with nanosecond to submicrosecond PTTI objectives. Two receiver configurations were fabricated for use in satellite-to-laboratory experiments. In one receiver the delay-locked loop for PN signals synchronization used a dithered amplitude detection process while the second receiver used a complex sums phase detection method for measurement of delay error. The necessity for compensation of Doppler shift is discussed. Differences in theoretical signal acquisition and tracking performance of the design concepts are noted. Author

N75-11289* Naval Observatory, Washington, D.C.
PRECISE TIME AND TIME INTERVAL DATA HANDLING AND REDUCTION
Laura C. Fisher *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 215-237 (For availability see N75-11275 02-35)
CSCL 05B

In the past year, the increase in Precise Time And Time Interval data to be reduced to the U.S. Naval Observatory Master Clock and the requirement for its quick dissemination has necessitated development of more efficient methods of data handling and reduction. An outline of the data involved and of the Time Service computerization of these functions is presented. Author

N75-11290* Naval Observatory, Washington, D.C.
STATISTICAL PROPERTIES OF HIGH PERFORMANCE CESIUM STANDARDS
Donald B. Percival *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 239-263 refs (For availability see N75-11275 02-35)
CSCL 14B

The intermediate term frequency stability of a group of new high-performance cesium beam tubes at the U.S. Naval Observatory were analyzed from two viewpoints: (1) by comparison of the high-performance standards to the MEAN (USNO) time scale and (2) by intercomparisons among the standards themselves. For sampling times up to 5 days, the frequency stability of the high-performance units shows significant improvement over older commercial cesium beam standards. Author

N75-11291* Harvard Univ., Cambridge, Mass.
FLEXIBLE BULB LARGE STORAGE BOX HYDROGEN MASER c36
Victor Reinhardt *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 265-282 refs Sponsored in part by ONR (For availability see N75-11275 02-35)
CSCL 20E

The principal limitation on the accuracy of the hydrogen maser as a primary frequency standard has been the irreproducibility of the frequency shift caused by collisions of the radiating atoms with the walls of the vessel containing them. The flexible bulb-large storage box hydrogen maser allows correction for this wall shift within a single device, sidestepping the reproducibility problem, and reducing the frequency error from the wall shift to the level imposed by the device's stability. The principles of the device are discussed including the flexible bulb technique and the complications caused by a multiple region storage bulb. The stability of the device is discussed including a comparison with an ordinary hydrogen maser. Data is presented from a working flexible bulb-large storage box hydrogen maser demonstrating the feasibility of the device and showing some of its operating characteristics. The flexibility of the device is demonstrated by showing how the device's added degrees of freedom allow measurement of parameters unmeasurable in an ordinary hydrogen maser. Author

N75-11292* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARACTERISTICS OF ADVANCED HYDROGEN MASER FREQUENCY STANDARDS c36
Harry E. Peters *In its* Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 283-316 refs (For availability see N75-11275 02-35)
CSCL 20E

In house research and development at Goddard Space Flight Center to provide advanced frequency and time standards for the most demanding applications is concentrated primarily in field operable atomic hydrogen masers. Some of the most important goals for the new maser designs have been improved long and short term stability, elimination of the need for auto tuning, increased maser oscillation level, improved hydrogen economy, increased operational life, minimization of operator control or monitoring, improvement in magnetic isolation or sensitivity, and reduction in size and weight. New design concepts which have been incorporated in these masers to achieve these goals are described. The basic maser assemblies and control systems have recently been completed; the masers are oscillating; and operational testing has begun. Data illustrating the improvements in maser performance was available and presented. Author

N75-11293* Coast Guard, Washington, D.C.
ALL CHAIN LORAN-C TIME SYNCHRONIZATION c04
H. T. Sherman *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 317-336 (For availability see N75-11275 02-35)
CSCL 17G

A program is in progress to implement coordinated universal time (UTC) synchronization on all Loran-C transmissions. The present capability is limited to five Loran-C chains in which the tolerance is twenty-five microseconds with respect to UTC. Upon completion of the program, the transmissions of all Loran-C chains will be maintained within five microseconds of UTC. The improvement plan consists of equipping selected Loran-C transmitting stations for greater precision of frequency standard adjustment and improved monitoring capability. External time monitor stations will utilize television time transfer techniques with nearby SATCOM terminals where practicable, thus providing

the requisite traceability to the Naval Observatory. The monitor equipment groups and the interrelationships with the ground station equipment are discussed. After a brief review of control doctrine, forth-coming improvements to transmitting stations and how the time monitor and navigation equipments will complement each other resulting in improved service to all users of the Loran-C system are described. Author

N75-11294* International Astronomical Latitude Station, Cagliari (italy).
STABILITY AND NOISE SPECTRA OF RELATIVE LORAN-C FREQUENCY COMPARISONS c04
Edoardo Proverbio, V. Quesada, and A. Simoncini *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 337-348 refs (For availability see N75-11275 02-35)
CSCL 17G

Relative comparisons of Loran-C frequency transmissions between the master station of Catanzaro (Simeri Crichi) and the X, Z slave stations of Estartit (Spain) and Lampedusa (Italy) are carrying out by the GG LORSTA monitor station of the Mediterranean Sea Loran-C chain. These comparisons are able to emphasize the relative and, under certain conditions, the absolute rate of the emitting standard frequencies of the slave stations and some relevant statistical properties of the Loran-C Method for frequency transmission and time synchronization. The stability of each Loran-C frequency standard transmission is subject to perturbations, more or less known, due to the propagation medium and other causes. Following the Allan (1966) method for data processing, the performance of the relative rate of frequency of the transmissions of the X, Z slave stations are described calculating the standard deviation of a set of N frequency measurements from its mean averaged during sampling times. This standard deviation is designated as the measure of the stability of the Loran-C frequency transmission. Author

N75-11295* Federal Aviation Administration, Washington, D.C.
AN AERONAUTICAL BEACON SYSTEM USING PRECISE TIME c04
T. S. Amlie *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 349-367 (For availability see N75-11275 02-35)
CSCL 17G

An experimental system using precise time techniques is under construction and will be tested in 1974. It will provide accurate surveillance data to the ground based ATC sensors, high capacity data link ground-to-air and air-to-ground, navigation services and air-to-air collision avoidance and proximity warning service. The design takes into account the large disparity in electronic equipment among the various classes of users. The user of the airspace installs only that equipment required for the services he needs. Author

N75-11296* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOCK SYNCHRONIZATION EXPERIMENTS USING OMEGA TRANSMISSIONS c04
Andrew R. Chi and S. C. Wardrip *In its* Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 369-395 refs (For availability see N75-11275 02-35)
CSCL 17G

The OMEGA transmissions from North Dakota on 13.10 and 12.85 kHz were monitored at several sites using a recently developed OMEGA timing receiver specifically designed for this purpose. The experiments were conducted at Goddard Space Flight Center, Greenbelt, Maryland; U.S. Naval Observatory, Washington, D.C.; and at the NASA tracking station, Rosman, North Carolina. Results show that cycle identification of the two carrier frequencies was made at each test site, thus, coarse time (76 microseconds) from the OMEGA transmitted signals to within the ambiguity period of each OMEGA frequency was extracted. The fine time determination, which was extracted from the phase difference between the received OMEGA signals and locally generated signals, was about + or - 2 microseconds for daytime reception and about + or - 5 microseconds for nighttime reception. Author

N75-11297* Polytechnic Inst. of New York.
THE CORRELATION OF VLF PROPAGATION VARIATIONS WITH ATMOSPHERIC PLANETARY-SCALE WAVES c32
D. J. Cavalieri, R. J. Deland, Thomas A. Potemra (APL), and R. F. Gavin (APL) *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 397-426 refs (For availability see N75-11275 02-35)
CSCL 17B

Variations in the received daytime phase of long distance, cesium-controlled, VLF transmission were compared to the height variations of the 10-mb isobaric surface during the first three months of 1965 and 1969. The VLF phase values are also compared to height variations of constant electron densities in the E-region and to variations of f-min which have been shown to be well correlated with planetary-scale variations in the stratosphere by Deland and Cavalieri (1973). The VLF phase variations show good correlation with these previous ionospheric measurements and with the 10-mb surfaces. The planetary scale waves in the stratosphere are shown to be travelling on the average eastward in 1965 and westward in 1969. These correlations are interpreted as due to the propagation of travelling planetary scale waves with westward tilted wave fronts. Upward energy transport due to the vertical structure of those waves is also discussed. These correlations provide further evidence for the coupling between the lower ionosphere at about 70 km altitude (the daytime VLF reflection height and the stratosphere, and they demonstrate the importance of planetary wave phenomena to VLF propagation. Author

N75-11298* Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC EFFECTS ON ONE-WAY TIMING SIGNALS c32
H. Soicher and F. J. Gorman, Jr. *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 427-441 refs (For availability see N75-11275 02-35)
CSCL 17B

A proposed navigation concept requires that a user measure the time-delay that satellite-emitted signals experience in traversing the distance between satellite and user. Simultaneous measurement of the propagation time from four different satellites permits the user to determine his position and clock bias if satellite ephemerides and signal propagation velocity are known. A pulse propagating through the ionosphere is slowed down somewhat, giving an apparent range that is larger than the equivalent free space range. The difference between the apparent range and the true range, or the free space velocity and the true velocity, is the quantity of interest. This quantity is directly proportional to the total electron content along the path of the propagating signal. Thus, if the total electron content is known, or is measured, a perfect correction to ranging could be performed. Faraday polarization measurements are continuously being taken at Fort Monmouth, N. J., using beacon emissions of the ATS-3 (137.35 MHz) satellite. Day-to-day variability of the diurnal variation of total electron content values is present with differences of up to 50% or more not being uncommon. In addition, superposed on the overall diurnal variation are smaller scale variations of approximately 5 to 10% of the total content which are attributed to ionospheric density irregularities. Author

N75-11299* Naval Electronics Lab. Center, San Diego, Calif.
A SYNOPTIC STUDY OF SUDDEN PHASE ANOMALIES (SPA'S) EFFECTING VLF NAVIGATION AND TIMING c04
E. R. Swanson and C. P. Kugel *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 443-475 refs (For availability see N75-11275 02-35)
CSCL 17G

Sudden phase anomalies (SPA's) observed on VLF recordings are related to sudden ionospheric disturbances due to solar flares. Results are presented for SPA statistics on 500 events observed in New York during the ten year period 1961 to 1970. Signals were at 10.2kHz and 13.6kHz emitted from the OMEGA transmitters in Hawaii and Trinidad. A relationship between SPA frequency and sun spot number was observed. For sun spot number near 85, about one SPA per day will be observed

somewhere in the world. SPA activity nearly vanishes during periods of low sun spot number. During years of high solar activity, phase perturbations observed near noon are dominated by SPA effects beyond the 95th percentile. The SPA's can be represented by a rapid phase run-off which is approximately linear in time, peaking in about 6 minutes, and followed by a linear recovery. Typical duration is 49 minutes. Author

N75-11300* Army Topographic Command, Washington, D.C.
RESULTS OF THE LONG RANGE POSITION-DETERMINING SYSTEM TESTS **c04**
Frederick W. Rhode *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 477-502 (For availability see N75-11275 02-35)
CSCL 17G

The long range position-determining system (LRPDS) has been developed by the Corps of Engineers to provide the Field Army with a rapid and accurate positioning capability. The LRPDS consists of an airborne reference position set (RPS), up to 30 ground based positioning sets (PS), and a position computing central (PCC). The PCC calculates the position of each PS based on the range change information provided by each Set. The positions can be relayed back to the PS again via RPS. Each PS unit contains a double oven precise crystal oscillator. The RPS contains a Hewlett-Packard cesium beam standard. Frequency drifts and off-sets of the crystal oscillators are taken in account in the data reduction process. A field test program was initiated in November 1972. A total of 54 flights were made which included six flights for equipment testing and 48 flights utilizing the field test data reduction program. The four general types of PS layouts used were: short range; medium range; long range; tactical configuration. The overall RMS radial error of the unknown positions varied from about 2.3 meters for the short range to about 15 meters for the long range. The corresponding elevation RMS errors vary from about 12 meters to 37 meters. Author

N75-11301* National Bureau of Standards, Boulder, Colo.
THE COLOR BAR PHASE METER: A SIMPLE AND ECONOMICAL METHOD FOR CALIBRATING CRYSTAL OSCILLATORS **c35**
D. D. Davis *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 503-504 (For availability see N75-11275 02-34)
CSCL 14B

Comparison of crystal oscillators to the rubidium stabilized color burst is made easy and inexpensive by use of the color bar phase meter. Required equipment consists of an unmodified color TV receiver, a color bar synthesizer and a stop watch (a wrist watch or clock with sweep second hand may be used with reduced precision). Measurement precision of 1 x 10 to the minus 10th power can be realized in measurement times of less than two minutes. If the color bar synthesizer were commercially available, user cost should be less than $200.00, exclusive of the TV receiver. Parts cost for the color bar synthesizer which translates the crystal oscillator frequency to 3.579MHz and modulates the received RF signal before it is fed to the receiver antenna terminals is about $25.00. A more sophisticated automated version, with precision of 1 x 10 to the minus 11th power would cost about twice as much. Author

N75-11302* Defense Communications Agency, Washington, D.C.
A TIME REFERENCE DISTRIBUTION CONCEPT FOR A TIME DIVISION COMMUNICATION NETWORK **c32**
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 505-527 refs (For availability see N75-11275 02-35)
CSCL 17B

Starting with an assumed ideal network having perfect clocks at every node and known fixed transmission delays between nodes, the effects of adding tolerances to both transmission delays and nodal clocks is described. The advantages of controlling tolerances on time rather than frequency are discussed. Then a concept is presented for maintaining these tolerances on time throughout the network. This concept, called time reference distribution, is a systematic technique for distributing time reference to all nodes of the network. It is reliable, survivable and possesses many other desirable characteristics. Some of its features such as an excellent self monitoring capability will be pointed out. Some preliminary estimates of the accuracy that might be expected are developed and there is a brief discussion of the impact upon communication system costs. Time reference distribution is a concept that appears very attractive. It has not had experimental evaluation and has not yet been endorsed for use in any communication network. Author

N75-11303* Defense Communications Agency, Washington, D.C.
FUTURE DCS OBJECTIVES IN COMMUNICATION NETWORK TIMING AND SYNCHRONIZATION **c32**
Joseph R. Mensch *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 529-541 (For availability see N75-11275 02-35)
CSCL 17B

The Defense Communication System will be moving rapidly toward providing switched digital service to it's users within the next ten years. The principal driving force in the transition to a digital system is the requirement for high performance secure voice service. Additionally, the anticipated data requirements in this time frame can be handled most effectively by a digital network. The characteristics of a switched digital network which impose timing and synchronization requirements on the system design are presented. Several alternative approaches to implementing a timing subsystem suitable for a switched digital communications system have been considered. These include pulse stuffing, independent stable clocks, and clock correction techniques. The advantages and disadvantages of each approach are discussed relative to both the strategic and tactical communication system requirements. Author

N75-11304*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROWAVE INTERFEROMETRY TECHNIQUE FOR OBTAINING GAS INTERFACE VELOCITY MEASUREMENTS IN AN EXPANSION TUBE FACILITY
Charles C. Laney, Jr. 13 Nov. 1974 31 p refs
(NASA-TM-X-72625) Avail: NTIS HC $3.75 CSCL 14B

A microwave interferometer technique to determine the front interface velocity of a high enthalpy gas flow, is described. The system is designed to excite a standing wave in an expansion tube, and to measure the shift in this standing wave as it is moved by the test gas front. Data, in the form of a varying sinusoidal signal, is recorded on a high-speed drum camera-oscilloscope combination. Measurements of average and incremental velocities in excess of 6,000 meters per second were made. Author

N75-11305*# Scientific Translation Service, Santa Barbara, Calif.
STRAIN GAUGE STANDARD VDI/VDE 2635, BONDED ELECTRIC RESISTANCE STRAIN GAUGES, CHARACTERISTICS AND TESTING CONDITIONS
Washington NASA Nov. 1974 115 p refs Transl. into ENGLISH from VDI/Verband Deut. Elektrotech. (Dusseldorf), 1974 p 1-31
(Contract NASw-2483)
(NASA-TT-F-16005) Avail: NTIS HC $5.25 CSCL 14B

The guideline contains the definition of strain gauge parameters and how they are to be determined, as well as how measurements are to be taken and presented. Author

N75-11306*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MAXOMETER-DYNAMIC AND STATIC TESTS
Dennis W. Camp and Robert E. Turner Oct. 1974 19 p refs
(NASA-TM-X-64892) Avail: NTIS HC $3.25 CSCL 14B

The ability to withstand extreme environmental conditions, such as the high flow velocities and extreme temperatures associated with the launch of aerospace vehicles, was considered in the developement of two maxometer models which are capable of measuring extremely high wind speeds (130 m/sec) and retaining a record of the peak speed over any given time period.

The dynamic and static tests of these models are reported, along with pertinent results. Author

N75-11307*# National Aeronautics and Space Administration. Pasadena Office, Calif.

METHOD AND APPARATUS FOR MEASUREMENT OF TRAP DENSITY AND ENERGY DISTRIBUTION IN DIELECTRIC FILMS Patent Application

Joseph Maserjian, inventor (to NASA) (JPL) Filed 11 Nov. 1974 17 p

(Contract NAS7-100)

(NASA-Case-NPO-13443-1; US-Patent-Appl-SN-522551) Avail: NTIS HC $3.25 CSCL 14B

A report is made on the use of a tunnel injection method and apparatus to measuring trap densities and distribution in dielectric films in metal-dielectric-semiconductor structures. Under applied bias to the transistor gate, carriers (electrons or holes) tunnel into traps in the dielectric film. The resulting space charge tends to change channel conductance. By feeding back a signal from the source contact to the gate electrode, channel conductance is held constant, and by recording the gate voltage as a function of time, trap density can be determined as a function of distance from the dielectric-semiconductor interface. The process is repeated with the gate bias voltage at different levels in order to determine the energy distribution of traps as a function of distance from the interface. NASA

N75-11308*# National Aeronautics and Space Administration. Pasadena Office, Calif.

AN INDICATOR PROVIDING CONTINUOUS INDICATION OF THE PRESENCE OF A SPECIFIC POLLUTANT IN AIR Patent Application

Charles G. Miller (JPL) and Ralph E. Bartera, inventors (to NASA) (JPL) Filed 7 Nov. 1974 12 p

(Contract NAS7-100)

(NASA-Case-NPO-13474-1; US-Patent-Appl-SN-521817) Avail: NTIS HC $3.25 CSCL 14B

The continuous HCl in-air indicator consists of a tube-like element with an inlet end through which a continuous stream of air containing HCl enters. The air flows downstream from the inlet end and exits at the element's outlet end. First and second space apart photoelectric units are preferably positioned adjacent the inlet and outlet ends, respectively. Ammonia gas is injected into the air, flowing through the element, at a position between the two photoelectric units. The ammonia gas reacts with the HCl in the air to form ammonium chloride particles. The difference between the outputs of the two photoelectric units is an indication of the amount of HCl in the air stream. NASA

N75-11309*# National Aeronautics and Space Administration. Pasadena Office, Calif.

MAGNETOMETER USING A SUPERCONDUCTING ROTATING BODY Patent Application

Melvin M. Saffren (JPL) and Daniel D. Elleman, inventors (to NASA) (JPL) Filed 11 Nov. 1974 24 p

(Contract NAS7-100)

(NASA-Case-NPO-13388-1; US-Patent-Appl-SN-522552) Avail: NTIS HC $3.25 CSCL 14B

The construction and operation of a magnetometer which uses a superconducting, freely rotatable body sensitive to an incident magnetic field are discussed. The instrument is based on the application of the de-Haas Van Alpen effect to measure the direction and strength of an unknown magnetic field. The device provides intrinsic levitational stability to the measuring sphere, low power requirements, and a simplified unit for use in outer space. NASA

N75-11310*# West Virginia Univ., Morgantown. Dept. of Electrical Engineering.

APPLICATION AND SENSITIVITY INVESTIGATION OF FOURIER TRANSFORMS FOR MICROWAVE RADIOMETRIC INVERSIONS

John J. Holmes and Constantine A. Balanis 15 Nov. 1974 99 p refs

(Grant NGR-49-001-056)

(NASA-CR-140754) Avail: NTIS HC $4.75 CSCL 14B

Existing microwave radiometer technology now provides a suitable method for remote determination of the ocean surface's absolute brightness temperature. To extract the brightness temperature of the water from the antenna temperature equation, an unstable Fredholm integral equation of the first kind was solved. Fast Fourier Transform techniques were used to invert the integral after it is placed into a cross-correlation form. Application and verification of the methods to a two-dimensional modeling of a laboratory wave tank system were included. The instability of the Fredholm equation was then demonstrated and a restoration procedure was included which smooths the resulting oscillations. With the recent availability and advances of Fast Fourier Transform techniques, the method presented becomes very attractive in the evaluation of large quantities of data. Actual radiometric measurements of sea water are inverted using the restoration method, incorporating the advantages of the Fast Fourier Transform algorithm for computations. Author

N75-11311# California Univ., Livermore. Lawrence Livermore Lab.

FEASIBILITY STUDY OF A GUNN-DIODE MICROWAVE CAVITY SPECTROMETER AS A FORMALDEHYDE MONITOR Final Report

L. W. Hrubesh Feb. 1974 100 p refs

(Contract W-7405-eng-48)

(UCID-16488) Avail: NTIS HC $4.75

A prototype of a fixed frequency microwave spectrometer to detect a pure rorational absorption transition of the H2(1) C12O16 molecule is described. The instrument was laboratory tested for use as a continuous monitor of formaldehyde in air. Design considerations, principles of operation, and calibration procedures are discussed. F.O.S.

N75-11312# Brigham Young Univ., Provo, Utah.

INSTRUMENTATION FOR CONTINUOUSLY RECORDING PLASMA-INDUCED FREQUENCY SHIFTS OF TWO MICROWAVE CAVITY RESONANCES M.S. Thesis

R. P. Evans Apr. 1974 61 p refs

(Contract AT(11-1)-2180)

(COO-2180-3) Avail: NTIS HC $4.25

Instrumentation was developed for the continuous recording of the frequency shifts of two resonances of a spherical microwave cavity. These changes in the resonant frequency are caused by the presence of a plasma in an electrostatic confinement system. To detect the frequency shifts, a digitally controlled samplehold circuit is employed which senses the resonances of the cavity in the two states, plasma and no plasma. The two states are controlled by high voltage, applied to the inner sphere of the confinement system, which is line-synchronously switched on and off with a vacuum switch. Tests of the system, with quiet operation, show that shifts of the order of two parts in 10 to the 6th power can be detected by this method.

Author (NSA)

N75-11313# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.

ULTRASONIC TEST EQUIPMENT ALIGNMENT

R. W. Andrews 11 Jun. 1974 9 p

(Contract AT(29-2)-656)

(GEPP-129) Avail: NTIS HC $3.25

When conventional techniques of alignment of ultrasonic test equipment did not produce consistently accurate results, a unique alignment system was devised. Calibration of the inspection equipment is accomplished by the use of disc assemblies with accurately located flat bottomed holes, which are used as standard ultrasonic reflectors. In a hypothetical scan of a circular area, the ultrasonic beam is at all times parallel with the axis of the transducer, perpendicular to the area being scanned, and on a spiral whose origin is coincident with the center of the circular area. However, in actual practice angular errors of yaw and pitch as well as lateral and vertical displacement errors are present. In this new alignment technique, the transducer beam travels on a radial path from one rim to another, passing through the center, scanning the flaw twice. Perfect alignment is obtained when the returns from the two passes are coincident.

Author (NSA)

N75-11314# Kernforschungsanlage, Juelich (West Germany). Zentralinst. fuer Reaktorexperimente.

BEHAVIOUR OF GAS THERMOMETERS IN THE TEMPERA-

TURE RANGE FROM 300 TO 3000 K
H. J. Leyers Oct. 1973 53 p refs In GERMAN
(JUL-1009-RX) Avail: AEC Depository Libraries HC $5.75

The theoretical principles of gas thermometers are presented. It is shown that measurement and registration of temperatures up to 3,000 K is feasible by means of specially designed gas thermometers, which are described in detail. The advantages of these gas thermometers in comparison with other types of temperature sensors are described, although the latter may be less complicated with regard to technical and design features. NSA

N75-11315# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
USE OF A FILTER BANK SIGNAL PROCESSOR FOR LASER ANEMOMETRY
R. J. Baker Mar. 1974 32 p
(AERE-R-7652) Avail: AEC Depository Libraries HC $4.75; UK £L 1.00

The operation and validation of a filter bank frequency analyser is described as used for processing the Doppler signal in laser anemometry. The validation of the instrument is demonstrated with both real and artificial signals. The results indicate that high accuracy may be achieved even at substantial turbulence levels with a poor signal quality, and low duty cycle. NSA

N75-11316# Danish Atomic Energy Commission, Risoe.
SIMPLE THERMOSTAT BASED ON A TEMPERATURE REGULATED GAS STREAM
E. B. Anderson and J. Fenger Mar. 1974 8 p refs
(RISO-M-1694) Avail: AEC Depository Libraries HC $4.00

The construction and performance of a gas-stream thermostat are described. The thermostat was developed for Moessbauer measurements, but can also be used in connection with other types of spectrometry. In the present form it was used in the temperature range 150 to + 250 C, with a regulating sensitivity of + or - 0.5 C. Author (NSA)

N75-11317# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
INSTRUMENTAL TECHNIQUES IN THE OPTICAL MAGNETIC MODULATION SPECTROSCOPY
V. Montelatici 7 Nov. 1973 23 p In ITALIAN
(LNF-73-65) Avail: AEC Depository Libraries HC $4.25

The modulation of magnetic fields is discussed along with the relative differential of absorption and reflection. Other topics discussed include: criteria on the extent of the magnetic field modulation; criteria for the spectral extent of the electromagnetic source; response of synchronous detectors; and the modulation of polarization. Transl. by F.O.S.

N75-11318# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER-CONTROLLED APPARATUS FOR PERMEABILITY MEASUREMENTS AT CONFINING PRESSURES UP TO 10 TO THE 8TH POWER PASCAL (1000 BAR)
R. Quong and J. Baker 7 May 1974 19 p refs
(Contract W-7405-eng-48)
(UCID-30073) Avail: NTIS HC $3.25

A computer-controlled apparatus for determining the permeability of porous media via the measurement of gas flow is described. Measurements are made in the Darcy-flow regime in small, cylindrical rock samples at confining pressures up to 10 to the 8th power pascal (15,000 psi) and at water saturations up to 60%. This enables the permeability to be measured at conditions similar to those in a rock formation. Data acquisition is greatly facilitated through use of a time-shared PDP-9 computer, programmed to control equipment operation and to reduce the accumulated data. Author (NSA)

N75-11319# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
RADIOFREQUENCY SUPERCONDUCTOR MAGNETOMETER
E. P. Balsamo, G. Paterno, G. Lucano, S. Pace, and G. L. Romani 2 Nov. 1973 12 p refs
(LNF-73-55) Avail: AEC Depository Libraries HC $4.00

A point-of-contact superconductor magnetometer was developed. A point-of-contact superconductor magnetometer or SQUID (superconducting quantum interference device) consists essentially of a superconducting cylinder interrupted by a weak link coupled to a resonating circuit at a frequency of about 20 MHz. The operating priciples of this device are outlined. The circuit for the instrument, its operating characteristics, and its performance are described. The application of the device in the field of medicine, biophysics, and gravitational wave detection is indicated. NSA

N75-11320# Army Foreign Science and Technology Center, Charlottesville, Va.
METHOD OF ESTIMATING THE CORRELATION FUNCTIONS OF AN INHOMOGENOUS RANDOM FIELD OF OPTICAL DENSITIES
V. S. Sokolov, B. V. Pronin, and G. E. Pronina 2 Mar. 1974 18 p refs Transl. into ENGLISH from Geodeziya i Kartografiya (USSR), no. 8, Aug. 1972 p 51-59
(AD-784740; FSTC-HT-23-1836-73) Avail: NTIS CSCL 14/5

Microphotometry is a principal method of analyzing local objects in aerial photographs: it results in a photometric profile of the particular image as a function of optical densities randomly distributed over the area under examination. The authors developed a method for obtaining the optimal correlation function for the random sampling of optical density information in an image area. GRA

N75-11321# Air Force Systems Command, Wright-Patterson AFB, Ohio.
NEW PHOTOREDUCERS
N. P. Kozhevnikov 4 Mar. 1974 23 p refs Transl. into ENGLISH from Tr. Tsent. Nauch. Issled. Inst. Geod., Aerosemki i Kartograffi (Moscow), no. 165, 1966 p 56-66
(AD-784290; FSTC-HT-23-1219-73) Avail: NTIS CSCL 14/5

Enterprises of the GMGK have recently been equipped with stereophotogrammetric devices and the techniques of photogrammetric bunching have been improved. This permitted a considerable reduction in the geodetic network of field points for preparation of aerophotos in topographic mapping on scales of 1:25,000 and 1:10,000. New photoreducers have been developed (the single-projector PRS and the four-projector model) which permit direct optical reduction of grids of 80-90 cm to a base scale with an error of no more than 0.2-0.3 mm (averaging 0.10-0.15 mm). In the extensive development of the analytic method of three-dimensional phototriangulation, the use of the new photoreducers has great promise since they are needed for all work where photogrammetric bunching is done on a general-purpose instrument. The four-projector device detects and avoids patterned distortions. GRA

N75-11322# Army Foreign Science and Technology Center, Charlottesville, Va.
A STUDY OF THE POSSIBILITY OF USING PHOTOGRAPHIC MATERIALS FOR THE VISUALIZATION OF SINGLE PULSES OF AN ELECTROMAGNETIC FIELD IN THE INVISIBLE REGION OF THE SPECTRUM
V. M. Ginzburg, B. M. Stepanov, and B. I. Federovskii 30 Aug. 1973 4 p Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 15, no. 3, 1970 p 205-206
(AD-784301; FSTC-HT-23-1312-73) Avail: NTIS CSCL 20/6

It is shown to be possible to record very short single pulses of invisible radiation (lambda = 1.06 micron) from a neodymium laser on Unibrom photographic paper which has been previously exposed in a developer to weak diffuse light to give a faint grey density. GRA

N75-11323# Varian Associates, Palo Alto, Calif.
PORTABLE VAPOR SURVEILLANCE SYSTEM Final Report
James T. Arnold and Paul Robbiano Jun. 1974 97 p refs
(Contract DAAD05-72-C-0253)
(AD-782844; LWL-CR03P68C) Avail: NTIS CSCL 14/2

A portable membrane separator-mass spectrometer vapor detection system has been developed. Components of the system are housed in two light weight aluminum suitcases. The system operates from commercial power lines and can be set up quickly and conveniently wherever 110 volt 60 Hz power is available. Internal operation is under microcomputer control with an operator's visual display showing computer processed data. The

operator may select any of a number of modes and programs via switches which communicate with the computer. Although the microcomputer was developed specifically for this application, it is a true general purpose device with a full instruction set, direct memory addressing to 32K words and very extensive input-output capability. It thus can be applied with low cost to a variety of other applications. Author (GRA)

N75-11324# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
EVALUATION OF A PORTABLE GAS ANALYZER FOR THE DETERMINATION OF CARBON DIOXIDE IN NITROGEN
M. Perlman 14 Jun. 1974 9 p refs
(AD-783033; NADC-74137-30) Avail: NTIS CSCL 14/2

A portable gas contaminant detector system modified for on-site analysis of aviator's breathing oxygen has been found to have adequate sensitivity and accuracy for low level detection of CO2 in N2. Author (GRA)

N75-11325# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF MEASURING VELOCITY AND PHOTOGRAPHING MODELS IN BALLISTICS TESTS
A. N. Berezkin, V. N. Bykov, A. G. Gordeev, V. G. Maslennikov, and A. M. Smudenkov 28 Jun. 1974 16 p refs Transl. into ENGLISH from the book "Aerofizicheskie Issledovaniya Sverkhzvukovykh Techenii" USSR, 1967 p 218-267
(AF Proj. 1987)
(AD-783575; FTD-HT-23-1358-74) Avail: NTIS CSCL 14/2

The application of photoelectric techniques for measuring the velocity of free flight projectiles is discussed. The characteristics of photomultiplier devices are described. A block diagram of a typical test installation is provided. The performance of a Kerr cell is examined to show adaptation to the ballistics measurement installation. The test equipment is capable of measuring the flow spectra of the model, determining the separation between the shock wave and the body, analyzing the shape of the shock wave, and locating the position of the sonic point on the body. Author

N75-11326# Army Material Command, Texarkana, Tex. Intern Training Center.
THE SURVEY AND DEVELOPMENT OF EQUIPMENT AND TECHNIQUES CAPABLE OF MONITORING AUTOMOTIVE EXHAUST EMISSIONS Final Report
Alton Douglas Reeves Mar. 1973 141 p refs
(AD-784026; USAMC-ITC-2-73-18) Avail: NTIS CSCL 07/4

The national concern over the contribution of automotive emissions to air pollution has provided the impetus for the establishment of stringent emission control requirements. With this is the need to have available suitable instrumentation capable of monitoring exhaust emissions and insuring that pollution control devices are operating effectively. This study surveys the instrumentation available capable of monitoring exhaust emissions. Included are equipment types, their principles of operation, their operating characteristics, their sources, and their particular applications. Material relevant to emission measurement systems is generally covered. Development work on a simple colorimetric method of detecting carbon monoxide in automotive exhaust is carried out. Although a simple light emitting diode and phototransistor circuit performs well in detecting the reactions involved, complications to the system are threatened by a number of variables which have to be closely controlled. Author (GRA)

N75-11327# Air Force Academy, Colo.
THE DESIGN OF A LOW COST SOUND LEVEL METER Final Report, 1 Jan. 1972 - 1 Jul. 1974
John D. Griffiths Apr. 1974 44 p refs
(AD-783808; USAFA-TR-74-6; EPA-550/9-74-008) Avail: NTIS CSCL 20/1

Conventional sound level meters generally use precision ceramic microphones and discrete solid state circuitry. This report describes a design using an electret microphone and integrated circuit operational amplifiers. The advantages of this design are low cost, ease of manufacture, stable gain, and low power consumption. Construction details are included to permit local manufacture. The complete instrument is capable of meeting the Type 2, General Purpose Sound Level Meter, requirements of ANSI S1.4-1971, American National Standard Specification for Sound Level Meters. Author (GRA)

N75-10993* Kanner (Leo) Associates, Redwood City, Calif.
DEVELOPMENT OF THE DESIGN OF A BETWEEN-THE-LENS BAND TYPE PHOTOGRAPHIC SHUTTER
A. S. Dorofeyev *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 42-47 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 28-30 (For availability see N75-10988 02-18)
CSCL 14E

N75-10995* Kanner (Leo) Associates, Redwood City, Calif.
MULTIPLE-SLIT SHADOW DEVICE FOR SENSING THE DIRECTION TO A SHINING OBJECT
A. V. Bruns *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 65-87 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 43-58 (For availability see N75-10988 02-18)
CSCL 14B

N75-11426* Scientific Translation Service, Santa Barbara, Calif.
FILM PROCESSING IN SCIENTIFIC SPACECRAFT TELEVISION SYSTEMS
G. M. Aleshin *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 59-66 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 51-56 (For availability see N75-11419 02-43)
CSCL 14E

N75-11427* Scientific Translation Service, Santa Barbara, Calif.
REDUCTION OF IMAGE BLURRING ON INDIVIDUAL AERIAL PHOTOGRAPHS
Yu. I. Fivenskiy and Yu. L. Biryukov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 67-74 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 57-63 (For availability see N75-11419 02-43)
CSCL 14E

N75-11505 World Meteorological Organization, Geneva (Switzerland).
CORRELATION SPECTROSCOPY TECHNIQUES FOR THE REGIONAL AND GLOBAL MEASUREMENTS OF AIR POLLUTION
J. H. Davies *In its* Observation and Meas. of Atmospheric Pollution 1974 p 282-296 refs (For availability see N75-11476 02-45)

N75-11506 World Meteorological Organization, Geneva (Switzerland).
A CRITICAL APPRAISAL OF THE PERFORMANCE OF THE AIR SAMPLING EQUIPMENT USED IN THE EUROPEAN AIR SAMPLING NETWORK
J. L. Brownscombe, M. R. Porter, and P. Goldsmith *In its* Observation and Meas. of Atmospheric Pollution 1974 p 297-306 refs (For availability see N75-11476 02-45)

N75-11508 World Meteorological Organization, Geneva (Switzerland).
AN ATMOSPHERE HYDROGEN FLUORIDE MONITOR
Joke Kaaijk *In its* Observation and Meas. of Atmospheric Pollution 1974 p 316-323 refs (For availability see N75-11476 02-45)

N75-11509 World Meteorological Organization, Geneva (Switzerland).
MONITORING OF CO, SO2 AND HC IN AIR BY GAS CHROMATOGRAPHY
Fabrizio Bruner and Paolo Ciccioli *In its* Observation and Meas. of Atmospheric Pollution 1974 p 324-333 refs (For availability see N75-11476 02-45)

N75-11516 World Meteorological Organization, Geneva (Switzerland).
METHOD OF MEASUREMENT OF VERY LOW CONCENTRATIONS OF SUBMICRON AEROSOLS
S. Ohta and T. Ito *In its* Observation and Meas. of Atmospheric Pollution 1974 p 387-393 refs (For availability see N75-11476 02-45)

N75-11526 World Meteorological Organization, Geneva (Switzerland).
THE INTEGRATING NEPHELOMETER AS AN INSTRUMENT FOR MEASURING THE SCATTERING COEFFIEIENT OF THE ATMOSPHERE AND ITS USE IN ATMOSPHERIC POLLUTION STUDIES
J. A. Garland *In its* Observation and Meas. of Atmospheric Pollution 1974 p 490-505 refs (For availability see N75-11476 02-45)

N75-11527 World Meteorological Organization, Geneva (Switzerland).
GROUND-BASED MEASUREMENTS OF SOLAR RADIATION BY GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE (USA)
Douglas V. Hoyt and Gary A. Herbert *In its* Observation and Meas. of Atmospheric Pollution 1974 p 506-515 refs (For availability see N75-11476 02-45)

N75-11529* World Meteorological Organization, Geneva (Switzerland).
MICROWAVE ROTATIONAL SPECTROSCOPY: A PHYSICAL TECHNIQUE FOR SPECIFIC POLLUTANT MONITORING
Lawrence W. Hrubesh *In its* Observation and Meas. of Atmospheric Pollution 1974 p 526-537 refs (For availability see N75-11476 02-45)
(NASA Order L-75902; Contracts EPA-IAG-D179(D))

36 LASERS AND MASERS

Includes parametric amplifiers.

N75-11328# Joint Publications Research Service, Arlington, Va.
GAS DYNAMIC LASER WITH ELECTRIC EXCITATION OF A THERMALLY IONIZED GAS
A. S. Biryukov, V. M. Marchenko, and L. A. Shelepin 30 Oct. 1974 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 217, no. 3, 1974 p 540-543
(JPRS-63317) Avail: NTIS HC $3.25

The possibility of increasing the inversion in a gas dynamic CO2 laser by exciting the molecules by electron collision in a discharge is studied. Author

N75-11329# Dayton Univ. Research Inst., Ohio.
THE AIR FORCE WEAPONS LABORATORY LASER WINDOW TEST APPARATUS Final Report, Jun. 1972 - Jun. 1973
P. W. Dueweke, D. D. Preonas, and D. G. Peterson, Jr. Jun. 1974 144 p
(Contract F29601-72-C-0122; AF Proj. 3326)
(AD-783852; AFWL-TR-73-181) Avail: NTIS CSCL 20/5

The Laser Window Test Apparatus (LWTA) evaluates windows and other optical components for high-power infrared laser systems. Specimens are probed with narrow beams from low-power lasers (currently CO2 lasers) to determine their optical characteristics at incidence angles between 2 and 76 degrees from the normal. The instrument includes a photometer that uses digitized ratiometric detection for measuring single-pass transmittance and single-pass reflectance; an interferometer for measuring the optical pathlength through specimens; a rastering machine for moving the specimens in relation to the probing beams; and a minicomputer controls measurements, performs on-line calibrations, computes running statistical records of the acquired data, and generates an output tape of all data for use by a CDC-6600 computer program which generates the data in its final form and accuracy. (Modified author abstract) GRA

N75-11330# Los Alamos Scientific Lab., N.Mex.
POTENTIAL LASERS FOR LCTR APPLICATIONS
J. S. Gilbert, T. F. Stratton, and R. J. Jensen 1974 21 p refs Presented at Topical Meeting on Technol. of Controlled Nucl. Fusion, San Diego, Calif., 16 Apr. 1974
(Contract W-7405-eng-36)
(LA-UR-74-594; Conf-740402-14) Avail: NTIS HC $3.25

Laser performance requirements for conceptual laser controlled thermonuclear reactor power plants are reported. Several lasers that may eventually satisfy the requirements for laser-fusion power plants are discussed. An electron-beam-controlled discharge CO2 laser power amplifier conceptual design for producing 125 kJ output in pulses of approximately one nanosecond duration is described. Author (NSA)

N75-11331# Sandia Labs., Albuquerque, N.Mex.
VACUUM-ULTRA-VIOLET XENON LASER
A. W. Johnson and J. B. Gerardo 1973 4 p refs Presented at 8th Intern. Quantum Electron. Conf., San Francisco, 10 Jun. 1974 Sponsored by AEC
(SLA-74-5032; Conf-740617-1) Avail: NTIS HC $3.25

The addition of helium as a diluent to xenon improves the performance of the vacuum-ultraviolet (VUV) xenon laser. A numerical model and the experimental results demonstrate that the 1720 Angstrom xenon laser can be efficiently utilized. Author (NSA)

N75-11332# Bendix Corp., Kansas City, Mo.
LASER REMOVAL OF DIELECTRIC FROM FLAT CABLES
R. T. Horn Apr. 1974 15 p ref
(Contract AT(29-1)-613)
(BDX-613-820-Rev) Avail: NTIS HC $3.25

Material reaction to pulsed and continuous laser modes of operation was analyzed in relation to the use of a carbon dioxide laser for removing dielectric from flat flexible cables. Microscopic examination and electrical continuity inspection were used to evaluate the results. Author

N75-11333# Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
LASER RADIATION: BIOLOGIC EFFECTS AND HAZARD EVALUATION
S. M. Michaelson 1974 81 p refs Sponsored by AEC
(UR-3490-537) Avail: NTIS HC $4.75

The biological effects, and hazards associated with lasers were studied. The pathophysiological damage which are caused by thermal effects, and acoustic transients are discussed. Thresholds for damage to the eye for different wavelengths are also discussed. Laser hazards and safety precautions are given. F.O.S.

N75-11334# California Univ., Livermore. Lawrence Livermore Lab.
LASER DISC COMPUTER SIMULATION
J. B. Sonderman and A. T. Glassman 14 May 1974 21 p
(Contract W-7405-eng-48)
(UCID-16499) Avail: NTIS HC $3.25

An evaluation of an eight disc laser amplifier was made. One of the tests consisted of a wavefront distortion test of the entire assembly using a Mach Zehnder interferometer. Later it was decided to use a computer program to model this same experiment. The POLYPAGOS lens evaluation program was chosen. The objective was to analytically determine the wavefront distortion of a laser beam passing through a series of eight discs with specified surface figures, and compare the data with experimental results. NSA

N75-11335# Los Alamos Scientific Lab., N.Mex.
EFFECT OF LASER RADIATION ON THIN FILMS
G. L. Gurevich and V. A. Muravev 1974 15 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 1, 1973 p 3-8 Sponsored by AEC
(LA-tr-74-15) Avail: NTIS HC $3.25

The problem of laser radiation heating of thin, metallic or semiconducting films which have been deposited on a dielectric backing is considered. Attention is primarily given to the mode of heating when elements of small dimension (on the order of several microns) are obtained. Time-independent and nonstationary temperature fields are calculated, and the threshold values of the power densities necessary for destruction of the film are determined. Author (NSA)

N75-11336# Sandia Corp., Albuquerque, N.Mex. Theoretical Fluid Dynamics Div.
NUMERICAL SOLUTION FOR ELECTRON-BEAM-

CONTROLLED CO2 LASER PERFORMANCE
J. B. Moreno Apr. 1974 59 p refs
(Contract AT(29-1)-789)
(SLA-73-1023) Avail: NTIS HC $4.25

A computer program was developed to predict the performance of the electron-beam-controlled CO2 Laser. The program accomplishes this prediction in three steps. First, the quasi-steady Boltzmann equation for electrons is solved. Next, the resulting nonequilibrium electron distribution function is folded into the inelastic collision cross sections to obtain vibrational-level electron-pumping rates. Finally, the optical cavity, translational-rotational energy, and vibrational-rate equations are simultaneously solved. These three steps are repeated for each desired time increment. The program requires as inputs the electric field and current-density time histories, the cavity parameters, the initial gas temperature, pressure and composition, and tabulated collision cross sections. No adjustable constants are introduced. The time evolution of either small-signal gain or oscillator output power can be computed. Author (NSA)

N75-11337# Danish Atomic Energy Commission, Risoe. Research Establishment.
A NOTE ON THE MEANING OF COHERENT AND INCOHERENT WITH RESPECT TO A LASER DOPPLER VELOCIMETER
L. Lading and S. Hanson Apr. 1974 8 p refs
(RISO-M-1713) Avail: AEC Depository Libraries HC $4.00

The meaning of coherent and incoherent detection with respect to laser Doppler velocimeters is explained on the basis of how the contributions from the different scattering particles are superposed. An apparent paradox concerning the coherent superposition of contributions from different particles is resolved. Author

N75-11338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE KINETICS OF TWO-STAGE SELECTIVE PHOTODISSOCIATION OF MOLECULES BY LASER EMISSION
V. S. Letokhov and A. A. Makarov 13 Aug. 1974 38 p refs Transl. into ENGLISH from Kinet. Dvukhstupenchatoi Selektivnoi Fotodissotsiatsii Molekul Lazernym (USSR), 1972 p 1-14
(AD-784852; FTD-MT-24-1843-74; Preprint-2) Avail: NTIS CSCL 07/5

Two-stage photodissociation of molecules by laser radiation for selective bond breaking in molecules involves irradiation of a molecule by two laser pulses of different frequencies. One radiation is in resonance with the vibrational-rotational transition of the molecule and effects an oscillatory molecular excitation. The second radiation effects photodissociation of the oscillation-excited molecules. In practice the first radiation must be in the infrared region and the second in the ultraviolet. The relationships between the parameters of infrared and ultraviolet radiation which make it possible to satisfy this requirement, i.e., to obtain a considerable yield of the products of photodissociation with low losses of the energy of laser radiation are found. GRA

N75-11339# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LASER BEAM INTERACTION, PART 2 Final Report
P. D. Thomas, H. M. Musal, and Y. S. Chou Aug. 1974 60 p refs
(Contract DAAH01-74-C-0278)
(AD-784753; LMSC-D403747) Avail: NTIS CSCL 20/5

This report summarizes work performed during the concluding phase of a theoretical investigation into the physics responsible for the initiation and propagation of Laser Absorption Waves that have been observed to form over opaque solid targets irradiated in air by an intense laser beam. The report deals separately with the initiation of subsonic Laser Supported Combustion (LSC) waves over metal targets irradiated by a CO2 laser at intensities up to a few MW/sq cm for times of the order of milliseconds or longer; and with the prompt initiation of supersonic Laser Supported Detonation (LSD) waves by short-pulse irradiation at CO2 laser intensities of the order of 30 MW/sq cm or greater. GRA

N75-11340# Naval Postgraduate School, Monterey, Calif.
ANALYTICAL INVESTIGATION OF TRANSIENT DIFFUSER WAVE PHENOMENA M.S. Thesis
Kenneth Dean Aanerud Jun. 1974 77 p refs
(AD-783864) Avail: NTIS CSCL 20/5

A computer program was developed to solve the quasi-one-dimensional, unsteady flow problem associated with starting phenomena in various nozzle-short diffuser combinations of interest to gas dynamic lasers. The program was based on the techniques developed by George Rudinger in his book, Wave Diagrams for Nonsteady Flow in Ducts. The techniques were modified to facilitate a fixed grid for computational ease. The program was used to analyze the starting transients of a Mach 3 nozzle with a semi-wedge diffuser. Results indicated that for a given inlet/exhaust pressure ratio, diffuser starts could be obtained at higher ramp angles for thin diffusers than for thick diffusers. Author

N75-11341# Naval Research Lab., Washington, D.C.
DESIGN OF FANNED AND WEDGED STACKED PLATE POLARIZERS FOR HIGH POWER LASERS Final Report
Orville C. Barr and John M. McMahon Jul. 1974 38 p refs
(NRL Proj. 65H02-34)
(AD-783671; NRL-MR-2830) Avail: NTIS CSCL 20/5

A large aperture, low loss, high damage threshold polarizer design has been developed to meet the requirements arising in isolation of large glass laser systems. The design differs from traditional designs to achieve desired rejection ratios with fewer plates and lower transmission losses. Polarizers of this design have been fabricated, tested and installed in the high power glass laser at the Naval Research Laboratory. Author (GRA)

N75-11342# Aerospace Corp., El Segundo, Calif.
ATMOSPHERIC PRESSURE H2-F2 LASER INITIATED BY ELECTRON-BEAM IRRADIATED DISCHARGE Interim Report
Robert Hofland, Alfred Ching, Martin L. Lundquist, and James S. Whittier 15 Jul. 1974 18 p refs
(Contract F04701-74-C-0075)
(AD-784828; TR-0075(5240-50)-3; SAMSO-TR-74-195) Avail: NTIS CSCL 20/5

The authors have measured pulse energy and power versus time for the output of an HF laser pumped by the H2 - F2 chain reaction. Noble-gas-diluted atmospheric pressure mixtures were initiated uniformly with the use of a transverse electrical discharge established by partially ionizing the gas mixture with a burst of high energy electrons. As primary objectives, the authors sought to demonstrate atmospheric pressure operation and a laser output comparable to the electrical energy supplied for initiation. Performance as a function of several parameters was studied. GRA

N75-11343# Cornell Univ., Ithaca, N.Y.
STUDY OF MOLECULAR LASERS Semiannual Technical Report, 1 Oct. 1973 - 31 Mar. 1974
George J. Wolga, Ross A. McFarlane, Simon H. Bauer, and T. A. Cool Jul. 1974 31 p refs
(Contract N00014-67-A-0077-0006)
(AD-784774) Avail: NTIS CSCL 07/4

The report describes research performed at Cornell University aimed at furthering the understanding of energy transfer and deactivation mechanisms in chemical and molecular lasers as well as the study of new laser systems and new chemical sources for laser systems. The methodology employed consists of laboratory experiments, data analysis including computer modeling, and literature review. Work is reported in several areas: (1) measurement of the vibrational deactivation of HF(v = 1), CO2(001) and CO(v = 1) by collisions with. F, O, N, D, Cl atoms; (2) measurement of the rate of vibrational deactivation at low temperature of the bending mode of CO2(010) by argon; (3) completion of a complete computer model for the CS2-O, CO chemical laser system; (4) study of new H atom sources for HF lasers; and (5) laser double resonance studies of vibration to rotation energy transfer in HF. GRA

N75-11344# Boeing Aerospace Co., Seattle, Wash.
DOUBLE-PULSE LASER INTERACTION EXPERIMENTS Final Report, 26 Apr. - 26 Nov. 1973
R. B. Hall, W. E. Maher, and D. J. Nelson Jul. 1974 122 p refs

(Contract F29601-73-C-0085; AF Proj. 1905)
(AD-784868; D180-17844-1; AFWL-TR-73-296) Avail: NTIS CSCL 20/5

A double-pulse CO2 laser system has been constructed which emits 15 joules in each of the two pulses with a controllable pulse separation which can be varied from simultaneous to several seconds. With this system, high-power laser effects at solid surfaces in air are investigated at atmospheric pressure. Ignition thresholds of laser-supported detonation waves using thin foil targets are investigated for single laser pulses. The energy released in a laser-supported detonation wave leads to an air blast wave in the space near the target after the laser power has decayed. As a consequence, the gas density is reduced to approximately 1% of its ambient value and leads to an observed enhanced coupling for a second laser pulse. In the limit of perfect coupling, calculations are made of the expected temporal variation of surface temperature. Various experimental measurements are made of the high-temperature region near the target surface. (Modified author abstract) GRA

N75-11345# Naval Intelligence Support Center, Washington, D.C. Translation Div.
RADIATION SPECTRUM OF AN ELECTRIC IONIZATION CO2 LASER
N. G. Basov, E. M. Belenov, V. Aj Danilychev, O. M. Kerimov, and A. S. Podsosonnyi 1 Aug. 1974 45 p refs Transl. into ENGLISH from Akad. Nauk SSSR Fiz. Inst. (USSR), preprint no. 58, 1972
(AD-784796; NISC-Trans-3563) Avail: NTIS CSCL 20/5

A method of developing a molecular laser tunable in a broad part of the spectrum has been previously described. The method is based on the possibility of exciting vibrational-rotational transitions of the anharmonic molecule at pressures sufficient for smooth generation frequency retuning between rotational lines of the molecule that have overlapped because of collision broadening. This method became technically feasible with the appearance of electric ionization lasers whose working mixture pressure can be tens of atmospheres. The present work investigates the radiation spectrum of an electric ionization CO2 laser with working mixture pressures to 8 atm and with a wide variation in the percentage makeup of the working mixture (CO2 - N2). Sections are included on tunable lasers collision broadening and experimental results. GRA

N75-11346# Oklahoma State Univ., Stillwater. Dept. of Physics.
GROWTH AND HARDENING OF ALKALI HALIDES FOR USE IN INFRARED LASER WINDOWS Quarterly Technical Report
Charles T. Butler, Joel J. Martin, L. D. Merkle, William A. Sibley, and E. L. Sill 31 Jul. 1974 13 p refs
(Contract F19628-72-C-0306)
(AD-784750) Avail: NTIS CSCL 20/5

A Reactive Atmosphere Processing Bridgman KCl crystal growth system has been placed in operation. This system uses the now conventional CCl4 treatment method. The resultant undoped KCl crystals show a 10.6 micrometer absorption of 0.0004/cm. Flow stress measurements as a function of radiation damage on KBr(x) I(1-x) crystals have been started. A system for measuring the flow stress as function of temperature has been completed. Author (GRA)

N75-11347# United Aircraft Corp., East Hartford, Conn. Research Labs.
DEVELOPMENT OF A MINIATURIZED DYE LASER Interim Report, 10 Jun. - 10 Aug. 1974
William H. Glenn 8 Aug. 1974 11 p
(Contract N60921-74-C-0339)
(AD-784930; UARL-N921952-1) Avail: NTIS CSCL 20/5

The objective of this program is to develop a miniaturized dye laser suitable for a variety of applications, particularly in an underwater environment. Emphasis to date has been placed on the following tasks: evaluation of pump cavity configurations; investigation of increased flashlamp input energy; testing of various dyes in aqueous solutions. This report presents a summary of the results of these investigations, followed by a brief outline of plans for continuing work in the next reporting period. GRA

N75-11348# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
ANALYSIS OF CHEMICAL LASERS. VOLUME 5: ROTATIONAL RELAXATIONAL EFFECTS Final Report, 20 Sep. 1973 - 30 Jun. 1974
Juergen Thoenes Jun. 1974 38 p refs
(Contract DAAH01-74-C-0173; DA Proj. 1T5-62609-A-308)
(AD-784548; LMSC-HREC-TR-D390222-5; RK-74-13-Vol-5) Avail: NTIS

The previously developed Laser and Mixing Program (LAMP) theory is extended to explicitly include rotational relaxation effects. The theory considers the coupling between gasdynamic properties, cavity characteristics, and laser radiation for diffusion-type chemical laser oscillators. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. Author (GRA)

N75-11253* Maryland Univ., College Park. Dept. of Physics and Astronomy.
SECOND GENERATION TIMING SYSTEM FOR RANGING EXPERIMENT APOLLO LUNAR LASER
Douglas G. Currie, Charles Steggerda, John Rayner, and Albert Buennagel *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 41-45 (For availability see N75-11249 02-35)
(Grant NGR-21-002-267)
CSCL 20E

N75-11255* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA HYDROGEN MASER ACCURACY AND STABILITY IN RELATION TO WORLD STANDARDS
Harry E. Peters and Donald B. Percival (Naval Obs.) *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 55-61 refs (For availability see N75-11249 02-35)
CSCL 20E

N75-11291* Harvard Univ., Cambridge, Mass.
FLEXIBLE BULB LARGE STORAGE BOX HYDROGEN MASER
Victor Reinhardt *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 265-282 refs Sponsored in part by ONR (For availability see N75-11275 02-35)
CSCL 20E

N75-11292* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARACTERISTICS OF ADVANCED HYDROGEN MASER FREQUENCY STANDARDS
Harry E. Peters *In its* Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 283-316 refs (For availability see N75-11275 02-35)
CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N75-11349*# Mechanical Technology, Inc., Latham, N.Y.
SMALL, HIGH-SPEED BEARING TECHNOLOGY FOR CRYOGENIC TURBO-PUMPS
Leo W. Winn, Martin W. Eusepi, and Anthony J. Smalley Jul. 1974 224 p refs
(Contract NAS3-17773)
(NASA-CR-134615; MTI-74TR29) Avail: NTIS HC $7.25 CSCL 13I

The design of 20-mm bore ball bearings is described for cryogenic turbo-machinery applications, operating up to speeds of 120,000 rpm. A special section is included on the design of hybrid bearings. Each hybrid bearing is composed of a ball bearing in series with a conventional pressurized fluid-film journal bearing. Full details are presented on the design of a test vehicle which

possesses the capability of testing the above named bearings within the given speed range under externally applied radial and axial loads. Author

N75-11350*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF ELASTOHYDRODYNAMIC FILM THICKNESS MEASUREMENTS FOR FLUOROCARBON TYPE 2 ESTER, AND POLYPHENYL ETHER LUBRICANTS
Stuart H. Loewenthal, Richard J. Parker, and Erwin V. Zaretsky Washington Nov. 1974 30 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7825; E-7954) Avail: NTIS HC $3.75 CSCL 11H

A minimum films thickness correlation applicable to heavily loaded elastohydrodynamic (EHD) contacts was formulated from experimental data obtained by an X-ray transmission technique. The correlation, based on data generated with fluorocarbon, type II ester, and polyphenyl ether lubricants, extends a previous analysis developed from data for a synthetic paraffinic oil. The resulting correlation represents the data of the four lubricants reasonably well over a large range of operating conditions. Contained within the derived relation is a factor to account for the high-load dependence displayed by the measurements beyond that which is provided for by the theory. Thermal corrections applied to a commonly used film thickness formula showed little improvement to the general disagreement that exists between theory and test. Choice of contact geometry and material are judged to have a relatively mild influence on the form of the semiempirical model. Author

N75-11351*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLANGED MAJOR MODULAR ASSEMBLY JUG Patent Application
Meyer M. Gilman, inventor (to NASA) (Rockwell Intern. Corp.) Filed 25 Oct. 1974 30 p
(NASA-Case-MSC-19372-1; US-Patent-Appl-SN-517995) Avail: NTIS HC $3.75 CSCL 13I

The invention presents methods and means for attaching flanges to three-dimensional frameworks, called major modular assembly jigs, the word major implying a structure of some size while modular is intended to connote that two or more jigs are to be assembled to make a complete tooling and assembly jig. The overall assembly of modules provides working platforms and reference points and plates for the assembly and tool operation upon such large structures as spacecraft, aircraft, sea-going vessels and rail cars. NASA

N75-11352# Royal Aircraft Establishment, Farnborough (England).
TESTING MACHINE FOR THERMAL FATIGUE WITH VARIABLE CONSTRAINT RATIO
S. Taira, M. Fujino, and T. Haji May 1974 20 p refs Transl. into ENGLISH from J. Soc. Mater. Sci. (Japan), v. 22, 1973 p 110-116
(RAE-Lib-Trans-1759; BR42145) Avail: NTIS HC $3.25

The need, theory, and development of a successful system for controlling the constraint imposed by a servo-hydraulic test machine during thermal-cycle fatigue of cylindrical and tubular steel specimens is discussed. The effects of specimen surface finish, bulging, mean temperature, and control of temperature distribution are shown. Radio frequency heating and forced gas cooling of the specimen was employed. Author

N75-11353# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
WASTE LUBRICATING OIL RESEARCH: A COMPARISON OF BENCH-TEST PROPERTIES OF RE-REFINED AND VIRGIN LUBRICATING OILS
M. L. Whisman, J. W. Goetzinger, and F. O. Cotton 1974 22 p refs
(BM-RI-7973) Avail: NTIS HC $3.25

Samples of waste lubricating oil were re-refined and reformulated with additives to meet designated requirements for viscosity and service. Quality-defining bench scale tests were used to compare and evaluate the quality of these three motor oils, eight commercially re-refined lubricating oils, and three new lubricating oils. Most of the re-refined oils studied could not be distinguished from new oils by the bench tests used to define quality. There was some evidence, however, that one and perhaps more of the re-refined products investigated might not meet all the quality standards of new lubricating oil, suggesting the need for better quality controls by re-refiners. Author

N75-11354# California Univ., Livermore. Lawrence Livermore Lab.
POLYMER-LINED FILAMENT-WOUND PRESSURE VESSELS FOR NITROGEN CONTAINMENT
M. A. Hamstad, T. T. Chiao, and E. S. Jessop 1974 22 p refs Presented at the Meeting on Failure Modes in Composites II, Pittsburgh, 21 May 1974 Sponsored by AEC
(UCRL-75361; Conf-740521-1) Avail: NTIS HC $3.25

A program was started to develop fatigue-resistant polymeric liners for a filament-wound pressure vessel to contain nitrogen gas at room temperature. First nitrogen permeation of butyl rubber sheet coated with Saran and Parylene C was studied in flat specimens. Then four 10-cm-diam cylindrical pressure vessels were prepared with chlorobutyl rubber liners coated with the same materials. These vessels were valved off after nitrogen gas pressurization to approximately 65% (approximately 11.7 MPa or 1700 psig) of their expected failure pressure. One vessel leaked. The other three vessels showed an average pressure loss of less than 1% per month. These pressure vessels have an average performance factor of approximately 370 kPa.cu m/kg (1,500,000 in.) based on composite mass. Author

N75-11355# Bendix Corp., Kansas City, Mo.
SOLDER SLEEVES
J. R. Ensor May 1974 22 p Revised
(Contract AT(29-1)-613)
(BDX-613-1042-Rev) Avail: NTIS HC $3.25

Solder-sleeve terminations were prepared and tested to establish the equipment and techniques necessary to use solder sleeves in production of cables and rack-and-panel assemblies. Based on the results of electrical, mechanical, and environmental tests of both solder-sleeve and hand-soldered joints, the use of solder sleeves is considered a suitable alternative to hand soldering for many applications. Potential cost savings and improved product consistency are indicated. Author (NSA)

N75-11356# Bendix Corp., Kansas City, Mo.
FLEXCIRCUIT PROTECTIVE COATINGS
R. A. Hile May 1974 19 p refs
(Contract AT(29-1)-613)
(BDX-613-1068-Rev) Avail: NTIS HC $3.25

Protective coatings for use on Kapton-insulated flexcircuits were evaluated for abrasion resistance, tear strength, and flexibility. Tests were run on seven different protective coatings before and after a 300 F (149 C), 16-hour temperature cycle. Functional testing of the three most desirable protective coatings was performed on a typical flexcircuit used for a current application. On the basis of tests performed on the seven protective coatings, batiste, Tuftane, and nylon are useable for flexcircuit protection. Author (NSA)

N75-11357# Bendix Corp., Kansas City, Mo.
DEVELOPMENT OF A SELF-CONTAINED LAMINATING FIXTURE
J. D. Sheeley May 1974 14 p
(Contract AT(29-1)-613)
(BDX-613-927-Rev) Avail: NTIS HC $3.25

A bonding/laminating fixture with self-contained heating, cooling pressure, and vacuum features was developed. The fixture has been used successfully to laminate adhesive coated Mylar or Kapton insulators to etched circuits with a significant reduction in process cycle time. Author

N75-11358# Sandia Labs., Albuquerque, N.Mex. Aeroballistics Div.
VACUUM IMPULSE OF COMPRESSED, GAS VESSELS
M. D. Bennett May 1974 12 p refs
(Contract AT(29-1)-789)
(SLA-74-196) Avail: NTIS HC $3.25

The impulse produced when the gaseous contents of a pressurized tank are rapidly discharged into the atmosphere was

determined theoretically for perfect fluids with no heat transfer.
Author

N75-11359# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION AND OPTIMIZATION OF MICRO-OXIDATION TECHNIQUES EMPLOYED IN GAS TURBINE ENGINE OIL CHARACTERIZATION Technical Report, May 1967 - Dec. 1970
Eilhard Jantzen, G. Spengler, and George J. Morris May 1974 44 p refs Prepared in cooperation with DFVLR, Munich
(AF Proj. 7343)
(AD-784787; AFML-TR-74-11) Avail: NTIS CSCL 11/8

Rationale is provided which led to a modified oxidation-corrosion (O-C) test. Test methods, apparatus, and procedures are described for use up to 800F, a 20 milliliter amount of sample oil and a test time of 24 hours. The influence of various important parameters on oxidation-corrosion are presented. The reduction of the test duration to 24 hours was optimized. Oxidation/corrosion studies at several different temperatures and the resulting oil deterioration curves were shown to be meaningful from a minimum of 392F to a maximum of 700F. The selection of the proper air flow was coupled with the reduced sample size as most appropriate for this work. The selection of high purity metal catalysts was justified. Analysis methods used in this work and their relative merits are discussed. Finally oxidation-corrosion data is presented on a few typical base stocks using this method. (Modified author abstract) GRA

N75-11360# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIMENTAL INVESTIGATION OF THE COEFFICIENT OF SLIDING FRICTION DURING ROTATION OF A STEEL SHAFT IN A POLYMER BEARING
M. I. Voronin, P. A. Petrukhin, and B. M. Morosov 25 Apr. 1974 10 p refs Transl. into ENGLISH from Sb. Tr. (USSR), no. 8, 1968 p 15-21
(AD-783759; FSTC-HT-23-2202-72) Avail: NTIS CSCL 13/9

Results of comparative tests on the friction of bearings made of several polymer compositions are described. The level of energy losses on the friction of steel shaft in a bearing was selected as the evaluation criterion. The effect of operating conditions on the change of the magnitude of losses is discussed. GRA

N75-11361# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FEATURES OF THE PROCESS OF ONE AND TWO COMPONENT SURFACE ALLOYING OF ALLOY ZhS6-K FROM SUSPENSIONS
G. V. Zemskov, R. L. Kogan, and V. I. Moroz 27 Jun. 1974 16 p refs Transl. into ENGLISH from Zashch. Pokrytiya na Metallakh (USSR), no. 6, 1972 p 109-102
(FTD Proj. T74-01-43; FTD Proj. T74-04-11)
(AD-783564; FTD-MT-24-1342-74) Avail: NTIS CSCL 11/3

The work investigates the features of the process of saturation of alloy ZhS6-K by aluminum, silicon, boron, chromium, zirconium, and also aluminum together with the other indicated elements. Saturation was accomplished by the deposition of suspension, consisting of dispersed particles of the saturating elements and solution of nitrocellulose (colloxylin), on the surface of the sample after the homogenizing of samples in a protective atmosphere (argon, vacuum). GRA

N75-11362# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ULTRALOW FRICTION EFFECT
A. Presnyakov 17 Jul. 1974 5 p Transl. into ENGLISH from Gudok (USSR), no. 251, Oct. 1972 p 4
(AD-783928; FTD-HT-23-2120-74) Avail: NTIS CSCL 11/9

Soviet scientists discovered the phenomenon of ultralow friction of solids. The researchers observed that during irradiation of the surface of a polymer body, for example, of polyethylene rubbing with a metal in a vacuum, by a stream of accelerated helium atoms the transition from usual friction to ultralow friction is observed. Here, the value of the coefficient of friction reaches an order of thousandths. This effect was maintained in a wide range of velocities and large specific loads during the experiments. The authors believe that ultralow friction is caused by the fact that with the joint action of irradiation and friction a heating of the surface defects occurs. GRA

N75-11363# Westinghouse Electric Corp., Cheswick, Pa. Electro-Mechanical Div.
DESIGN AND DEVELOPMENT OF A SEGMENTED MAGNET HOMOPOLAR TORQUE CONVERTER Semiannual Technical Report
C. J. Mole, F. G. Arcella, R. Berkey, D. J. Boes, and R. A. Feranchak Jul. 1974 55 p refs
(Contract DAHC15-72-C-0229)
(AD-784302; EM-4602) Avail: NTIS CSCL 13/10

The purpose of the device is to convert unidirectional torque of constant speed (such as from a steam turbine prime mover) into variable speed output torque in either the forward or reverse directions. The concept offers an efficient, lightweight low volume design with potential application over a wide range of speeds and power ratings in the range from hundreds to tens of thousands of horsepower. This machine concept can be applied to commercial and military advanced concept vehicles for both terrain and marine environments. (Modified author abstract)
GRA

N75-11176* Pennsylvania State Univ., University Park.
TURBOMACHINERY DESIGN DESCRIBED BY SIMILARITY CONSIDERATIONS
George F. Wislicenus *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 7-39 refs Sponsored by NASA (For availability see N75-11174 02-34)
CSCL 21E

N75-11197* Northern Research and Engineering Corp., London (England).
IMPELLER BLADE DESIGN METHOD FOR CENTRIFUGAL COMPRESSORS
Willem Jansen and Andreas M. Kirschner *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 537-563 refs (For availability see N75-11191 02-34)
CSCL 13K

N75-11199* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSONIC COMPRESSOR TECHNOLOGY ADVANCEMENTS
William A. Benser *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 581-602 refs (For availability see N75-11191 02-34)
CSCL 13K

N75-11200* AiResearch Mfg. Co., Los Angeles, Calif.
BLADE SELECTION FOR A MODERN AXIAL-FLOW COMPRESSOR
L. C. Wright *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 603-626 refs (For availability see N75-11191 02-34)
CSCL 13K

N75-11201* Rocketdyne, Canoga Park, Calif.
AXIAL PUMPS FOR PROPULSION SYSTEMS
M. C. Huppert and K. Rothe *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 629-654 refs (For availability see N75-11191 02-37)
CSCL 13K

N75-11202* Aerojet Nuclear Systems Co., Azusa, Calif. NERVA Rocket Operations.
CENTRIFUGAL PUMPS FOR ROCKET ENGINES
W. E. Campbell and J. Farquhar *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 655-688 refs Sponsored jointly by NASA and AEC (For availability see N75-11191 02-34)
CSCL 13K

N75-11205* Pennsylvania State Univ., University Park.
AN INTRODUCTION TO THE DESIGN OF MARINE PROPULSORS

Robert E. Henderson *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 759-765 refs (For availability see N75-11191 02-34)
CSCL 13K

N75-11206* Naval Ship Research and Development Center, Washington, D.C.
APPLICATION OF THEORY TO PROPELLER DESIGN
G. G. Cox and William B. Morgan *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 767-793 refs (For availability see N75-11191 02-34)
CSCL 13K

N75-11207* Pennsylvania State Univ., University Park.
THE DESIGN OF PUMPJETS FOR HYDRODYNAMIC PROPULSION
Edgar P. Bruce, Walter S. Gearhart, John R. Ross, and Allen L. Treaster *In its* Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 795-839 refs (For availability see N75-11191 02-34)
(Contract N00017-70-C-1407)
CSCL 13K

N75-11208* Aerojet-General Corp., El Monte, Calif.
THEORY OF ONE-ELEMENT PUMPS FOR PROPULSION
Joseph Levy *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 2 1974 p 841-859 refs (For availability see N75-11191 02-34)
(Contract N00014-66-C-0014)
CSCL 13K

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N75-11364*# Wintec Corp., Los Angeles, Calif.
SHUTTLE FILTER STUDY. VOLUME 3: APPENDIX Final Report
Jun. 1974 143 p
(Contract NAS9-11264)
(NASA-CR-140338; WDB-2000-Vol-3) Avail: NTIS HC $5.75
CSCL 14D

Test data obtained from flow resistance and contaminant tolerance tests on the various porous media evaluated in the different fluids are presented in both graphical and tabular forms. Test procedures for both flow resistance and contaminant tolerance testing are presented, and the development of a system for continuously adding contaminant at a predetermined rate to a flowing fluid stream is described. Also included is a section describing the development effort of the self-indexing filter. This concept was adapted during this program for various shuttle applications. Author

N75-11365*# Wintec Corp., Los Angeles, Calif.
SHUTTLE FILTER STUDY. VOLUME 2: CONTAMINANT GENERATION AND SENSITIVITY STUDIES Final Report
Jun. 1974 126 p
(Contract NAS9-11264)
(NASA-CR-140337; WDB-2000-Vol-2) Avail: NTIS HC $5.75
CSCL 14D

Contaminant generation studies were conducted at the component level using two different methods, radioactive tracer technique and gravimetric analysis test procedure. Both of these were reduced to practice during this program. In the first of these methods, radioactively tagged components typical of those used in spacecraft were studied to determine their contaminant generation characteristics under simulated operating conditions. Because the purpose of the work was: (1) to determine the types and quantities of contaminants generated; and (2) to evaluate improved monitoring and detection schemes, no attempt was made to evaluate or qualify specific components. The components used in this test program were therefore not flight hardware items. Some of them had been used in previous tests; some were obsolete; one was an experimental device. In addition to the component tests, various materials of interest to contaminant and filtration studies were irradiated and evaluated for use as autotracer materials. These included test dusts, plastics, valve seat materials, and bearing cage materials. Author

N75-11366# Sandia Labs., Albuquerque, N.Mex.
SOME HUMAN-FACTOR APPLICATIONS TO QUALITY CONTROL IN A HIGH TECHNOLOGY INDUSTRY
L. V. Rigby and A. D. Swain 1974 20 p refs Presented at the Intern. Symp. on Human Factors in Quality Control, Buffalo, 29 May 1974 Sponsored by AEC
(SLA-74-5339; Conf-740518-1) Avail: NTIS HC $3.25

Quality control in high technology industries is discussed indicating the need for quality control in the development, paperwork, and communication of technology. Topics also discussed include: human error rates, inspector accuracy, and human redundancy. M.C.F.

N75-11367# Bendix Corp., Kansas City, Mo.
NONDESTRUCTIVE METHODS FOR THE ACCEPTANCE OF PLATING THICKNESS ON PRINTED CIRCUIT BOARDS
A. B. Abel 12 Sep. 1973 20 p
(Contract AT(29-1)-613)
(BDX-613-1044) Avail: NTIS HC $3.25

Nondestructive methods are described: (1) the beta-backscatter measurement of copper thickness on the surface of the printed circuit board panels; (2) the resistance measurement of plated through holes; and (3) a modification of the plated through hole resistance tester. The use of a light section microscope to measure the path width and thickness of printed circuit boards is discussed. NSA

N75-11368# Sandia Labs., Albuquerque, N.Mex.
NONDESTRUCTIVE TESTING FOR MECHANICAL DEFECTS IN ATJ-S GRAPHITE
J. H. Gieske, B. L. Butler, T. R. Guess, J. M. Freedman, and R. H. Marion May 1974 15 p refs
(Contract AT(29-1)-789)
(SLA-74-69) Avail: NTIS HC $3.25

The correlations between the results of both nondestructive testing (NDT) ultrasonic pulse echo and radiation-gaging techniques of flaw detection and the degradation of mechanical properties and density of ATJ-S graphite are presented. Control specimens containing few or no detectable flaws were of uniform density and had an average tensile strength of about 5000 psi; the specimens containing detectable flaws had substantial density variations and an average tensile strength of about 3400 psi. The location of ultimate fracture coincided with the location that had given the maximum NDT indication in five of the six flawed specimens. Author (NSA)

N75-11369# General Technology Systems Ltd., London (England).
AN INVESTIGATION OF THE EXPERIENCE AND IMPLICATIONS OF USING NON HI-REL COMPONENTS IN EUROPEAN SCIENTIFIC EXPERIMENTS. VOLUME 3: APPENDICES
G. E. Hall and P. Brunt Jun. 1974 406 p 3 Vol.
(Contract ESRO-SC/23-HQ)
(GT-7310-Vol-3-App; ESRO-CR(P)-521-Vol-3-App) Avail: NTIS

Processed data recorded during the investigation of standard non Hi-Rel electronic equipment parts used for seven successful ESRO satellites are presented. Reliability data are expressed in terms of operating times, checklist responses, and supporting notes for each of the major experiments carried onboard ESRO 1A, ESRO 1B, ESRO 2, HEOS 2, HEOS A1, HEOS A2, TD1-A, and ESRO 4. Information concerning the different data processing techniques used is provided, along with the final data sheets which reflect demonstrated orbital reliability as determined by percentage failure rates. For Vol. 1, see N75-10476; for Vol. 2, see N75-10477. ESRO

N75-11370# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
NONDESTRUCTIVE TESTING OF BERYLLIUM
Roger J. Runck Jul. 1974 84 p refs
(Contract DSA900-74-C-0616)

(AD-784942; MCIC-74-22) Avail: NTIS CSCL 11/6

Radiography with X-rays is the workhorse as a method of nondestructively testing beryllium. It is especially capable of revealing inclusions and it can detect voids in moderately thick sections. Ultrasonic and eddy-current tests can be used to supplement liquid-penetrant tests for identification of discontinuities near the surface. Acoustic emission is a relatively new nondestructive testing technique that has proven to be useful for evaluating beryllium under load, and more extensive use of this technique is likely in the future. Holographic interferometry has been used to detect strain, and thereby identify debonds, in beryllium structures. However, the method is not especially effective with materials having high modulus of elasticity, such as beryllium, because of the high stresses necessary to produce appreciable strain. (Modified author abstract) GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N75-11371*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.

DEVELOPMENT OF SOLUTION TECHNIQUES FOR NONLINEAR STRUCTURAL ANALYSIS Final Report

R. G. Vos and J. S. Andrews 30 Sep. 1974 169 p refs

(Contract NAS8-29625)

(NASA-CR-120525; D180-18325-1) Avail: NTIS HC $6.25 CSCL 20K

Nonlinear structural solution methods in the current research literature are classified according to order of the solution scheme, and it is shown that the analytical tools for these methods are uniformly derivable by perturbation techniques. A new perturbation formulation is developed for treating an arbitrary nonlinear material, in terms of a finite-difference generated stress-strain expansion. Nonlinear geometric effects are included in an explicit manner by appropriate definition of an applicable strain tensor. A new finite-element pilot computer program PANES (Program for Analysis of Nonlinear Equilibrium and Stability) is presented for treatment of problems involving material and geometric nonlinearities, as well as certain forms on nonconservative loading. Author

N75-11372*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE PREDICTION OF STRUCTURAL RESPONSE TO BUFFET FLOW: A STATE-OF-THE-ART REVIEW

Perry W. Hanson Dec. 1974 23 p refs Presented at 39th AGARD Structural and Mater. Meeting, Munich, 7-12 Oct. 1974

(NASA-TM-X-72627; L-9820) Avail: NTIS HC $3.25 CSCL 20K

Certain aspects of the dynamic system being discussed are reviewed and important structural and aerodynamic quantities of the system are discussed. A theoretical model is presented which relates these quantities to each other. These quantities are then each, in turn, considered in terms of the state of the art of determining the quantities and in terms of areas where further research is needed. The similarity laws and scaling relationships applicable to determining buffet structural response are then discussed, and areas where simplification is required or may be permissible are mentioned. Finally, the various types of model tests pertinent to predicting response of the aircraft structure to buffet flow are discussed. Author

N75-11373# Los Alamos Scientific Lab., N.Mex.

TENSILE FATIGUE BEHAVIOR OF MOLYBDENUM AT 1153 K

R. A. Yeske, W. V. Green, and E. G. Zukas 1974 7 p refs Presented by Topical Meeting on Technol. of Controlled Nucl. Fusion, San Diego, Calif., 16 Apr. 1974 Sponsored by AEC

(LA-UR-74-657; Conf-740402-26) Avail: NTIS HC $3.25

Molybdenum was creep tested at 1153 K under cyclic stress. The stress cycles used were 5 to 170 M Pascals. The log-log plot of engineering strain as a function of time increased linearly until there was a acceleration in creep rate followed by fracture. Metallographic examination showed not only deformation within the grains but also grain boundary cracking. Such behavior is normal also for constant stress creep tests. A comparison of time to rupture for cyclic stress experiment results with published data for constant stress creep tests at essentially the same test temperature showed that the time under cyclic conditions was shorter than it is under constant stress. Additional tests are being done to determine if factors other than cyclic stressing are responsible for this high creep rate. Author (NSA)

N75-11374# Argonne National Lab., Ill.

BILINEAR REPRESENTATIONS OF THE CYCLIC STRESS-STRAIN BEHAVIOR OF TYPES 304 AND 316 STAINLESS STEEL FROM 800 TO 1200 F

C. F. Cheng and C. Y. Cheng Feb. 1974 18 p refs

(Contract W-31-109-eng-38)

(ANL-8002) Avail: NTIS HC $3.25

Bilinear representations of the elastic-plastic strain-hardening behavior of Types 304 and 316 stainless steel under cyclic loading conditions between 800 and 1200 F and a strain rate of 4 X .001 s to the minus 1 power were determined. Effects of maximum strain, temperature, heat treatment, and tension hold time on bilinear hardening functions and coefficients were evaluated. At or below 0.25% maximum strain values of 1.0 and 1.5 X 10,000 psi are recommended for Types 304 and 316 stainless steel, respectively. Author (NSA)

N75-11375# Sandia Labs., Livermore, Calif.

USING CRACK-MOUTH DISPLACEMENT FOR MEASUREMENT AND CONTROL DURING FRACTURE TESTS

T. C. Mamaros and A. T. Jones Apr. 1974 20 p refs

(Contract AT(29-1)-789)

(SLL-73-5021) Avail: NTIS HC $3.25

Techniques are described for monitoring and controlling crack length by means of crack-mouth displacement measurements during fracture toughness tests. Analytical results demonstrate the usefulness of such measurements for a number of specimens. Testing experiences with a variety of brittle alloys, including binary uranium alloys, beryllium, and high strength aluminums, are discussed; results show that crack-mouth displacement can be used reliably to control fatigue crack growth in very brittle alloys. Author (NSA)

N75-11376# Sandia Labs., Albuquerque, N.Mex.

PRELIMINARY FRACTURE TOUGHNESS SURVEY OF HIGH STRENGTH STEEL SHEET

James P. Hickerson, Jr. Apr. 1974 19 p

(Contract AT(29-1)-789)

(SLA-73-498) Avail: NTIS HC $3.25

A fracture toughness survey was made of 2.04 mm thick sheet from six high-strength steels: 18Ni200, 18Ni250, 18Ni350, HP94-20, Almar 362, and PH 1408Mo. Additional tests were also conducted on weldments made on 18Ni200, Almar 362, and HP9-4-20. The test procedures, data analysis, and test results are presented. Author (NSA)

N75-11377# Bendix Corp., Kansas City, Mo.

MODIFIED PAPER HONEYCOMB AS AN ENERGY ABSORBER

L. C. Jackson May 1974 16 p refs

(Contract AT(29-1)-613)

(BDX-613-981-Rev) Avail: NTIS HC $3.25

The initial ultimate compressive stress was eliminated from the load deformation curve of a honeycomb structure, using a low modulus impregnating resin and a low density foam filler for the cells. A 24 lb/cu ft (384 kg/cu m) epoxy foam filled, resin-impregnated cotton linter chevron-paper honeycomb proved suitable as an alternate energy absorptive material for use in protective packaging. Author

N75-11378# Westinghouse Hanford Co., Richland, Wash.

FATIGUE-CRACK PROPAGATION BEHAVIOR OF INCOLOY 800 AT ELEVATED TEMPERATURES

L. A. James Nov. 1973 22 p refs Presented at the Pressure Vessels and Piping-Mater. Nucl. Conf., Miami Beach, Fla., 24

Jun. 1974
(Contract AT(45-1)-2170)
(HEDL-SA-662; Conf-740606-7) Avail: NTIS HC $3.25

Linear-elastic fracture mechanics techniques were used to characterize the fatique-crack propagation behavior of Incoloy 800 over the temperature range 75 to 1200 F. Materials grades 1 and 2 were found to exhibit essentially the same behavior over this range, with some exceptions noted at 1200 F. In general, crack growth rates increased with increasing test temperature, although the increases were less than previously noted for austenitic stainless steels. This difference is probably related to the superior oxidation resistance of Incoloy 800.
Author (NSA)

N75-11379# Los Alamos Scientific Lab., N.Mex.
RESPONSE OF IRON TO DYNAMIC COMPRESSION
J. E. Hockett and E. G. Zukas 1973 29 p refs Presented at Conf. on the Mech. Properties of Mater. at High Rates of Strain, Oxford, 2 Apr. 1974
(LA-UR-74-273; Conf-740413-1) Avail: NTIS HC $3.75

Compressive true stress-strain curves were determined for annealed iron at constant true-strain rates from .01 to 200/sec over a range of temperatures. The response of iron to dynamic compression was manifested by its resistance to deformation and by its mode of deformation. For a given temperature, an increase in the true-strain rate resulted in an increase in the flow stress, or resistance to deformation, at low strains. For a given strain rate, an increase in temperature (from 0.16 to 0.49 t sub m) produced a decrease in flow stress at low strains and a proportionately smaller decrease at large strains. The mode of deformation was revealed by metallographic examination of all deformed specimens: at high strain rates or at low temperatures, a large amount of mechanical twinning occurred. At higher temperatures and/or lower strain rates, deformation was either predominantly by slip or completely by slip. Author (NSA)

N75-11380# Bendix Corp., Kansas City, Mo.
PREDICTING COMPRESSIVE STRENGTH OF URETHANE FOAMS AT HIGH STRAINS Final Report
T. E. Neet May 1974 17 p refs Revised
(Contract AT(29-1)-613)
(BDX-613-1103-Rev) Avail: NTIS HC $3.25

Equations for predicting the restrained compressive strength of rigid urethane foam at any density and strain were developed. General equations representing all of the foam systems studied were defined for foam strengths at -65 and 77 F (-54 and 25 C), while no general equation could be developed for the foams tested at 250 F (121 C). Author (NSA)

N75-11381# Bendix Corp., Kansas City, Mo.
VIBRATION ANALYSIS
C. W. Berry, Jr. Dec. 1973 42 p refs
(Contract AT(29-1)-613)
(BDX-613-926-Rev) Avail: NTIS HC $3.75

Information necessary for the design of vibration isolation systems is presented. Measurement of vibration levels and equipment vibration fragility are discussed along with methods and materials for vibration isolation. An isolation test table having a natural frequency that is tunable from 0.5 to 20 Hz has been developed. Author (NSA)

N75-11382# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
WELDED JOINTS BETWEEN DIFFERENT MATERIALS, ILLUSTRATED BY THE EXAMPLE OF MATERIAL COMBINATIONS OF INTEREST IN NUCLEAR SCIENCE AND TECHNOLOGY
G. Metzger and R. Lison Oct. 1973 124 p refs In GERMAN
(JUL-1011-RW) Avail: AEC Depository Libraries HC $8.25

The data showing the hardness, microstructure, and alloying behavior of filler metal mixtures of some materials combinations welded together were obtained on samples fused in an electric arc furnace. The information gained from these data for the prediction of the weldability of a given materials combination proved to be useful in only a few of the cases examined, owing to quick cooling of the filler metal and the formation of brittle phases between filler metal and the material to be welded. All welded joints were carried out as butt welds in sheets of 2 or 3 mm thickness. The materials used include silver, aluminium, copper, copper-nickel alloys, chromium-nickel austenitic steel, niobium, nickel, nickel-chromium-iron alloys, titanium, vanadium, vanadium-titanium alloys, and a zirconium alloy. The welded joints were examined by metallographic methods, tensile stress tests, and bending stress tests. NSA

N75-11383# Sandia Labs., Livermore, Calif.
GRAPHICS APPLICATIONS FOR FINITE ELEMENT CODE PROCESSING
V. K. Gabrielson Apr. 1974 20 p Presented at 2d AEC Sci. Computer Inform. Exchange Meeting, New York, 2 May 1974 Sponsored by AEC
(SLL-74-5218; Conf-740512-4) Avail: NTIS HC $3.25

The application of interactive graphics to mesh generation and to output display processing of finite element codes is described. Author (NSA)

N75-11384# Argonne National Lab., Ill.
EFFECT OF RANDOM TEMPERATURE FLUCTUATIONS ON CREEP AND CREEP RUPTURE OF CYLINDRICAL TUBES
W. N. Huang and R. A. Valentin Feb. 1974 31 p refs
(Contract W-31-109-eng-38)
(ANL-8006) Avail: NTIS HC $3.75

The qualitative and quantitative implications of random temperature data are considered by deriving expressions for the expectation value and variance of quantities such as displacement and stress in creep of thin, pressurized tubes. A nondeterministic analog of an existing theory of creep rupture was used to study the impact of random temperature fluctuations on time to brittle and ductile rupture. Data for stainless steel, together with analytical consideration, were used to formulate qualitative generalizations of importance to the design process. Author (NSA)

N75-11385# United Kingdom Atomic Energy Authority, Harwell (England).
FATIGUE CHARACTERISTICS OF THE FLEXING MEMBERS OF THE HARWELL THERMOMECHANICAL GENERATOR
E. H. Cooke-Yarborough Mar. 1974 9 p refs
(AERE-R-7693) Avail: AEC Depository Libraries HC $3.25; HMSO 50p; BIS HC $2.15

Examination of data on fatigue of stainless steels shows that although there is a wide scatter in the number of cycles before fatigue failure, there is a much smaller scatter on the stress axis of the S/N curve. It was found that if any test specimen has survived a given stress for 10 to the 7th power cycles, no similar specimen failed when tested at stresses below 90% of that stress. This information, combined with the facts that the diaphragm is stressed to only 65% of the failure threshold stress, that the displacer spring is stressed more lightly still, that both components can be protected from corrosion, and that the one diaphragm tested had not failed after nearly 10 to the 10th power cycles, give good prospects that the thermomechanical generator will be able to operate indefinitely without suffering from fatigue of the flexing components. Author

N75-11386# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
A NEW MODEL FOR ELASTIC-PLASTIC TRUSSES
Philip G. Hodge, Jr. Jul. 1974 48 p refs
(Contract N00014-67-A-0113-0025; NR Proj. 064-429)
(AD-783093; AEM-H1-10) Avail: NTIS CSCL 11/6

The phenomenon of upper yield and lower yield for steel bars under uniaxial stress is well known but not fully understood. The actual behavior of a bar at stress levels between the two yield stresses will depend upon many minor variables which may not be controlled or even known, so that from a pragmatic point of view it is indeterminate. Several models are proposed in which the behavior of a bar in the indeterminate range is chosen for computational convenience. The models are applied to several examples, and their advantages and disadvantages are discussed. It is concluded that the specific models described are not reasonable tools for practical engineering problems, but that the concept is worthy of further study. Author (GRA)

N75-11387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURAL STRENGTH AND DEFORMATION OF GLASS-REINFORCED LAMINATES
Yu. M. Tarnopolskii and A. M. Skudra 30 Apr. 1974 317 p refs Transl. into ENGLISH from the monograph "Konstruktsionnaya Prochnost i Deformativnost Stekloplastikov" 1966 p 1-260
(AD-783454; FTD-MT-24-473-74) Avail: NTIS CSCL 11/9

Contents: Structural glass-reinforced laminates; The elastic properties of glass-reinforced laminates; Strength properties of glass-reinforced laminates; Effect of time on the deformation and strength of glass-reinforced laminates; The temperature effect on the deformation and strength of glass-reinforced laminates; Technology and strength of glass-reinforced laminates; Mechanical testing of glass-reinforced laminates. GRA

N75-11388# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
THERMOSTRUCTURAL ANALYSIS OF THREE-DIMENSIONAL ORTHOGONALLY REINFORCED CARBON-CARBON MATERIALS Final Report, Jan. - Mar. 1973
D. E. Geiler 5 Jun. 1974 29 p Sponsored by SAMSO
(AD-783209; TR-0074(4450-72)-1; SAMSO-TR-74-164) Avail: NTIS CSCL 11/4

Thermostructural analyses for reentry vehicle nose tips of three-dimensional, orthogonally reinforced, pyrolyzed carbon-carbon materials generally have been performed with the assumption that the material is cylindrically orthotropic. Examination of the material's actual heterogeneous construction indicates noncylindrical orthotropy with a circumferential variation of properties in a plane normal to the billet axis. A technique is used which recognizes the actual noncylindrical orthotropic behavior of these carbon-carbons and which provides a consistent set of constitutive constants from test data. Analytical results are provided for a ring and a nose tip which indicate the cylindrically orthotropic assumption can lead to very unconservative predictions of critical stresses and strains. Author (GRA)

N75-11389# Watervliet Arsenal, N.Y.
A UNIFIED FINITE ELEMENT APPROACH TO COLUMNS SUBJECTED TO NONCONSERVATIVE LOADS, WITH DAMPING EFFECTS AND VARIOUS END CONDITIONS
Julian J. Wu Jul. 1974 20 p refs
(AD-783483; WVT-TR-74020) Avail: NTIS CSCL 13/13

Using the concept of unconstrained field variables, a general adjoint variational principle is formulated for columns subject to nonconservative loads and with various end conditions. External damping as well as material damping are also included in the same formulations. Emanating from this variational principle, finite element techniques have been developed to include problems with a wide variety of end conditions of the column by simply varying the values of several parameters. These end parameters represent the degrees of flexibility, of damping, and the amount of tip mass, etc. Thus the critical loads of stability of the column structure can be determined for any of the load-end condition combinations using the same formulations and hence the same computer programs. Numerical results are presented for several combinations of parameters. Author (GRA)

N75-11390# Watervliet Arsenal, N.Y.
FINITE ELEMENT ANALYSIS OF SEVERAL SWAGE MANDREL DESIGNS
H. Goodheim and G. P. OHara Jun. 1974 51 p refs
(AD-783486; WVT-TR-74011) Avail: NTIS CSCL 13/9

Any approach to the design of swage mandrel has been difficult for three reasons. First, the analysis of short cylinders is difficult. Second, it is nearly impossible to obtain accurate experimental results on mandrels. Third, the sintered tungsten carbide material is unreliable. The NASTRA finite element program has made possible accurate analysis of the problem. Twelve different designs have been analyzed. These show how different geometries affect the stress distribution. They also show that a steel ball may be an inexpensive reliable swage mandrel. Author (GRA)

N75-11391# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
ANOMALIES IN MEASUREMENT OF RESIDUAL STRESS BY X-RAY DIFFRACTION
R. H. Marion and J. B. Cohen 1 Jul. 1974 49 p refs
(Contract N00014-67-A-0356-0008; NR Proj. 031-733)
(AD-783677; TR-9) Avail: NTIS CSCL 11/6

Residual stresses are expected to lead to a linear dependence of the interplanar spacing, d, on sine squared psi (where psi is the sample tilt) and the stress can be obtained from the slope of this line. As a result of the linear dependence a two-tilt method is often employed to obtain the stress. However, when a specimen is subjected to extensive plastic deformation large deviations from a straight line can occur and a two-point method can lead to an erroneous stress determination. The results reported here show that: (1) this is more likely to occur in homogeneous materials than in multiphase materials; (2) the oscillations follow closely the variation in peak intensity due to texture; and (3) the oscillations are caused by microstresses which are due to an orientation effect as suggested by Weidemann. A simple, easy-to-use procedure has been developed and tested to correct the data and obtain the correct macrostress. The materials used were Armco iron, steel and ordered Cu3Au. (Modified author abstract) GRA

N75-11392# Waterloo Univ. (Ontario). Dept. of Civil Engineering.
DETERMINATION OF STAGE 1 AND STAGE 11 CRACK PROPAGATION PERIODS IN FATIGUE: AN INDIRECT APPROACH Interim Report
H. R. Jhansale and C. V. B. Gowda 1974 41 p refs
(Grant AF-AFOSR-2120-71; AF Proj. 9782)
(AD-784915; AFOSR-74-1353TR) Avail: NTIS CSCL 11/6

Fatigue crack initiation (Stage 1) and fatigue crack propagation (Stage 11) periods in a given fatigue life can be determined by an indirect testing method. This method is based on a series of two level strain tests in which each axial specimen is strain cycled at an initial high strain amplitude for a specified number of cycles followed by low strain amplitude cycling to failure. The resulting behavior termed Initially Overstrained Long Life Behaviour, can be analysed to estimate the durations of Stage 1 and Stage 11 crack growth periods. A preliminary study of surface damage associated with this overstrained long life behaviour is also included. Author (GRA)

N75-11393# Army Foreign Science and Technology Center, Charlottesville, Va.
VIBRATION-ABSORBING PROPERTIES OF STRUCTURAL MATERIALS: A HANDBOOK
G. S. Pisarenko, A. P. Yakovlev, and V. V. Matveev 2 Apr. 1974 492 p refs Transl. into ENGLISH of the book "Vibroprogloshchayushchie Sovistva Konstruktsionnykh Materialov" Kiev, 1971
(AD-784925; FSTC-HT-23-1485-73) Avail: NTIS CSCL 11/6

This book is a reference book which presents data on the vibration-absorbing properties of materials for turbine blades, aircraft, etc. It is based on investigations conducted in the Institute Problems of the Ukrainian Academy of Sciences and the Kiev Polytechnical Institute. Part 1 of the book presents information on the dissipation of energy in materials basic methods for determining characteristics of energy dissipation during vibrations, and descriptions of testing devices. Part 2 provides information in the forms of tables and graphs for different types of vibrations for alloys and steels. A bibliography of 75 titles is included. GRA

N75-11394# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
VIBRATIONS OF AXIALLY LOADED STIFFENED CYLINDRICAL SHELLS. PART 1: THEORETICAL ANALYSIS Interim Report
Josef Singer and Aviv Rosen Feb. 1974 100 p refs
(Grant AF-AFOSR-2394-72; AF Proj. 9782)
(AD-784917; TAE-169; AFOSR-74-1362TR) Avail: NTIS CSCL 20/11

A method of analysis and a computer program were developed for determination of the frequencies and mode shapes of the free vibrations of stiffened cylindrical shells. The shells are stiffened by closely spaced stringers and rings, have different boundary conditions, and are subjected to either a static axial load or a hydrostatic pressure. The stiffeners are considered smeared over the shell. The system of equations which was obtained is solved

by a method known as the exact method. The theoretical investigation includes a study of the variation in frequencies and mode shapes with increase in the static load until buckling. The results of the present analysis are compared to those of other methods which appear in the literature, and good agreement is obtained. Author (GRA)

N75-11395# Bell Aerospace Co., Buffalo, N.Y.
STRESS ANALYSIS OF COLDWORKED FASTENER HOLES Technical Summary Report, Jun. 1973 - Mar. 1974
William F. Adler and Donald M. Dupree Jul. 1974 103 p refs
(Contract F33615-73-C-5170; AF Proj. 7351)
(AD-784920; AFML-TR-74-44) Avail: NTIS CSCL 11/6

The stress and strain distributions around an initially coldworked hole in a plate and the subsequent redistribution of the stresses and strains when the plate is subjected to a uniform tensile loading are evaluated both analytically and experimentally. An elastic-plastic finite element idealization is developed for a one-quarter inch diameter hole in a 7075-T6 aluminum alloy plate one-quarter inch thick. Stress and strain distributions are provided for a 6 mil radial expansion of the hole and at tensile load levels of 10,000 lb., 25,000 lb., 37,500 lb., and 42,500 lb. Moire interferometry was used to verify that the elastic-plastic finite element analysis is representative of the strain distributions in an actual fastener coldworking procedure which involves inserting a cylindrical sleeve into a nominal one-quarter inch diameter hole and then drawing an oversized mandrel through the hole to produce a symmetrical distribution of residual stresses around the hole. Previous experimental strain evaluations of holes in plates involved hole diameters of at least one inch. The moire mismatch technique and photographic enlargements of the moire patterns provided the accuracy required. The conditions in the vicinity of the hole associated with the sleeve insertion procedure did not reflect the idealized conditions used in the finite element analysis which prohibited a valid comparison between the experimental and computed results. Author (GRA)

N75-11396# Colorado State Univ., Fort Collins. Dept. of Physics.
NUCLEAR ACOUSTIC RESONANCE STUDY OF METALS Final Report
Robert G. Leisure Jul. 1974 8 p refs
(Grant AF-AFOSR-2042-71; AF Proj. 6813)
(AD-784904; AFOSR-74-1418TR) Avail: NTIS CSCL 20/12

Work covered by this grant has included the extension of nuclear acoustic resonance (NAR) to magnetic fields over three times higher than those used previously. The high temperature results in aluminum have been found to be in good agreement with a theory by P.A. Fedders. New effects have been discovered at low temperatures in aluminum. Perhaps most importantly, NAR has been extended to alloys and shown to be an important new tool for alloy work. GRA

N75-11397# Naval Intelligence Support Center, Washington, D.C. Translation Div.
DESIGN OF THIN REINFORCED SPHERICAL SHELLS ACTED UPON BY INTERNAL OR EXTERNAL UNIFORM PRESSURES
B. I. Sakharov 1 Aug. 1974 27 p refs Transl. into ENGLISH from Prochnost i Ustoichivost Tonkostennykh Aviats. Konstr. (USSR), v. 3, 1971 p 151-172
(AD-784777; NISC-Trans-3566) Avail: NTIS CSCL 20/11

Thin elastic spherical shells which are symmetrically reinforced with meridional and annular stiffening ribs and loaded by internal or external uniform compressive pressure are examined. GRA

N75-11398# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STABILITY OF AXISYMMETRIC FORM OF MOTION OF FLEXIBLE SHALLOW SHELLS
L. A. Staroselskii and B. Ya. Kantor 31 Jul. 1974 11 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 8, no. 10, 1972 p 12-19
(AD-784778; NISC-Trans-3560) Avail: NTIS CSCL 20/11

The stability of a sustained axisymmetric motion of the shell in relation to non-symmetric disturbances is investigated. GRA

N75-11399# Naval Intelligence Support Center, Washington, D.C. Translation Div.
STABILITY UNDER EXTERNAL PRESSURE OF ORTHOTROPIC CIRCULAR CYLINDRICAL SHELLS REINFORCED BY CIRCULAR RIBS
V. M. Kurnaev and V. A. Postnov 31 Jul. 1974 12 p refs Transl. into ENGLISH from Mekh. Tverd. Tela (USSR), no. 4, 1972 p 129-137
(AD-784779; NISC-Trans-3558) Avail: NTIS CSCL 20/11

The stability of reinforced orthotropic circular cylindrical shells is considered, taking into account the quantified distribution of circular ribs. It is assumed that ribs have a final rigidity for bending and tension and a zero rigidity for torsion. GRA

42 GEOSCIENCES (GENERAL)

N75-11400# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 335
30 Oct. 1974 51 p Transl. into ENGLISH from Russian reports
(JPRS-63322) Avail: NTIS HC $4.25

The report contains translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N75-11401# Joint Publications Research Service, Arlington, Va.
FAR EASTERN SCIENCE CENTER
L. Mogilevskiy 12 Nov. 1974 24 p Transl. into ENGLISH from Alma-Ata Znamya (USSR), no. 9, 1974 p 178-192
(JPRS-63417) Avail: NTIS HC $3.25

The activities of the 15 institutes of the Far Eastern Science Center are described. Author

N75-11402# National Oceanic and Atmospheric Administration, Rockville, Md.
INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES
Feb. 1974 85 p refs
(IFYGL-Bull-9) Avail: NTIS HC $4.75

Activities and programs are discussed for water pollution and control management for the Great Lakes. Canadian and U.S. projects are reported, indicating project status. Also included are task reports for the U.S. projects. M.C.F.

N75-11403# Bureau of Mines, Twin Cities, Minn. Mining Research Center.
TUNNEL BORING TECHNOLOGY: DISK CUTTER EXPERIMENTS IN METAMORPHIC AND IGNEOUS ROCKS
Roger J. Morrell and David A. Larson 1974 55 p refs
(BM-RI-7961) Avail: NTIS HC $4.25

Laboratory experiments with reduced scale cutter and cutter forces were performed to define the fundamental relationships governing disk cutter performance, and to develop a method of predicting disk cutter performance in soft, medium, and hard rocks. The rock cutting experiments were performed in four igneous and metamorphic rocks that ranged in compressive strength from 38,000 psi to 67,000 psi. A special testing machine called a linear cutter apparatus was used to load and traverse a free rolling disk cutter across a smooth rock surface. Crater depth, tangential cutter force, crater volume, specific energy versus normal cutter force, and crater width versus depth are defined. Performance prediction equations were developed using stepwise linear regression analysis techniques. A method of using these prediction equations to calculate the boring rate, the cutter spacing, and the torque and energy requirements of a full-scale boring machine was also developed. Author

N75-11404# Wisconsin Univ., Madison. Dept. of Soil Science.
EOLIAN ADDITIONS TO SOIL

M. L. Jackson 1974 13 p refs
(COO-1515-54) Avail: NTIS HC $3.25

The depositional mixing processes which account for the distribution of quartz oxygen isotope ratio variations in major soil and sediment areas of the world are examined. NSA

N75-11405# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Section.
ISOSTASY AND SEISMICITY OF THE EAST ASIA TRANSITIONAL ZONE
Yu. A. Pavlov and V. P. Semakin Apr. 1974 39 p refs Transl. into ENGLISH from the book "Izostaziya (Isostasy)" Moscow, Izd. Nauka, 1973 p 105-121
(AD-782598; DMAAC-TC-2018) Avail: NTIS CSCL 08/7

The problems discussed in the present work concern the isostatic condition of the earth's crust and the spatial distribution of earthquake hypocenters in the region which covers the water areas of the marginal seas of the Far East and the adjacent part of the Pacific Ocean, as well as the border land of the Asian continent towards the Pacific Ocean. GRA

N75-11256* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERY LONG BASELINE INTERFEROMETRY (VLBI) EARTH PHYSICS
Peter F. MacDoran *In* NASA. Goddard Space Flight Center Proc. of the 4th Precise Time and Time Interval Planning Meeting 17 Nov. 1972 p 62-73 refs (For availability see N75-11249 02-35)
(Contract NAS7-100)
CSCL 08E

N75-11260* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME AND FREQUENCY REQUIREMENT FOR THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM
Friedrich O. VonBun *In its* Proc. of the 4th Precise Time and Time Interval Planning Meeting 16 Nov. 1972 p 123-131 (For availability see N75-11249 02-35)
CSCL 08E

N75-11277* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TIME FREQUENCY REQUIREMENTS FOR RADIO INTERFEROMETRIC EARTH PHYSICS
J. B. Thomas and Henry F. Fliegel *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 15-31 (For availability see N75-11275 02-35)
CSCL 08E

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N75-11406*# Catholic Univ. of America, Washington, D.C. Dept. of Anthropology.
EARTH RESOURCES TECHNOLOGY SATELLITE-1 (ERTS-1) DATA AND ANTHROPOLOGY: USE OF THESE DATA IN CARRYING CAPACITY ESTIMATES FOR SITES IN UPPER VOLTA AND NIGER
Priscilla Reining, Principal Investigator 24 Nov. 1974 10 p Presented at the Amer. Anthropological Assoc. Meeting, Mexico City, 24 Nov. 1974 ERTS
(Contract NAS5-21970)
(E75-10001; NASA-CR-140687) Avail: NTIS HC $3.25 CSCL 08H

The author has identified the following significant results. Repetitively derived multispectral band imagery from ERTS-1 is now available for many parts of the earth's land surface and represents major new data sources for anthropological work in habitat, land use, and settlement patterns. A completed first step test of ERTS-1 data is available in carrying capacity estimates for Mossi, Hausa, and Sonrai sites derived from: (1) field work; (2) aerial photography; and (3) ERTS-1. Data can test more than one carrying capacity formula.

N75-11407*# California Earth Science Corp., Santa Monica.
LINEAMENTS IN BASEMENT TERRANE OF THE PENINSULAR RANGES, SOUTHERN CALIFORNIA
P. M. Merifield, Principal Investigator and D. L. Lamar 27 Sep. 1974 26 p refs Orginal contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contracts NAS2-7698; DI-14-08-0001-13911)
(E75-10003; NASA-CR-140725; TR-74-1) Avail: NTIS HC $3.75 CSCL 08G

The author has identified the following significant results. ERTS and Skylab images reveal a number of prominent lineaments in the basement terrane of the Peninsular Ranges, Southern California. The major, well-known, active, northwest trending, right-slip faults are well displayed; northeast and west to west-northwest trending lineaments are also present. Study of large-scale airphotos followed by field investigations have shown that several of these lineaments represent previously unmapped faults. Pitches of striations on shear surfaces of the northeast and west trending faults indicate oblique slip movement; data are insufficient to determine the net-slip. These faults are restricted to the pre-tertiary basement terrane and are truncated by the major northwest trending faults. They may have been formed in response to an earlier stress system. All lineaments observed in the space photography are not due to faulting, and additional detailed geologic investigations are required to determine the nature of the unstudied lineaments, and the history and net-slip of fault-controlled lineaments.

N75-11408*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Nov. 1974
Paul M. Merifield, Principal Investigator 5 Nov. 1974 2 p EREP
(Contract NAS2-7698)
(E75-10005; NASA-CR-140727; MPR-17) Avail: NTIS HC $3.25 CSCL 08G

There are no author-identified significant results in this report.

N75-11409*# Department of the Environment, Ottawa (Ontario). Applied Hydrology Div.
WATER SURVEY OF CANADA: APPLICATION FOR USE OF ERTS-A FOR RETRANSMISSION OF WATER RESOURCES DATA Progress Report, 1 Apr. - 30 Sep. 1974
R. A. Halliday, Principal Investigator and I. A. Reid Oct. 1974 6 p Sponsored by NASA ERTS
(E74-10805; NASA-CR-140499) Avail: NTIS HC $3.25 CSCL 08H

The author has identified the following significant results. The fact that water resources data can be retransmitted from remote areas of Canada by polar orbiting spacecraft to users in population centers on a near real time basis reliably, accurately, and at relative low cost continues to be demonstrated. Over 60,000 transmissions from the nine data collection platforms installed at Water Survey of Canada gauging stations have been received. The stage and ice-out data retransmitted via ERTS-1 have been plotted on a chart record produced by a water stage servo-manometer installed on the Albany River. The stage increased smoothly until shortly after noon on May 19, 1974. During this time the indicator showed that the ice surface was intact. The stage then dropped sharply and the indicator read that the ice was out. The erratic chart trace after that was consistent with the assumption that the ice surface had broken up and that some short duration jams of broken ice were occurring.

N75-11410# Joint Publications Research Service, Arlington, Va.
FURTHER DEVELOPMENT OF SCIENTIFIC RESEARCH IN THE FIELD OF GEOLOGY AND OF THE SURVEY AND EXPLORATION OF PETROLEUM AND GAS
V. V. Semenovich 12 Nov. 1974 16 p Transl. into ENGLISH from Sov. Geol. (Moscow), no. 7, 1974 p 3-12

(JPRS-63414) Avail: NTIS HC $3.25

A review is provided of principal directions of scientific research in the field of geology, exploration and prospecting for petroleum and gas that constitute priority significance for selecting the basic directions for exploratory-survey operations and for increasing their methodological level and economic efficiency.

Author

N75-11411*# Massachusetts Univ., Gloucester. Marine Station.

OCEAN COLOR, A THREE COMPONENT SYSTEM?

Charles S. Yentsch and William P. Owen 21 Sep. 1972 18 p refs

(Contract NAS5-21813)

(NASA-CR-139145) Avail: NTIS HC $3.25 CSCL 08J

This study measures the concentrations of phytoplankton chlorophyll and yellow substance in the coastal waters of the Gulf of Maine. Sea surface observations attempt to delineate the principal biochemical parameters responsible for sea surface color. It is shown that the reddish-brown water changed to a blue-green in the open gulf.

M.C.F.

N75-11412*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

LACIE ADP/PI JOINT CASE STUDY: ADP ANALYSIS GUIDELINES

T. C. Minter Oct. 1974 42 p

(Contract NAS9-12200)

(NASA-CR-140344; LEC-9248) Avail: NTIS HC $3.75 CSCL 05B

The procedure is described which was used to train automatic data processing (ADP) analysts to process ERTS 1 imagery from a 5 nm by 6 nm area in Delisle, Canada, and to estimate wheat acreage using training fields provided by photointerpreters. The exercise also served to evaluate and test current large area crop inventory experiment (LACIE) procedures.

Author

N75-11413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXPLORATION FOR FOSSIL AND NUCLEAR FUELS FROM ORBITAL ALTITUDES

Nicholas M. Short Nov. 1974 59 p

(NASA-TM-X-70781; X-923-74-322) Avail: NTIS HC $4.25 CSCL 08G

Results from the ERTS program pertinent to exploration for oil, gas, and uranium are discussed. A review of achievements in relevant geological studies from ERTS, and a survey of accomplishments oriented towards exploration for energy sources are presented along with an evaluation of the prospects and limitations of the space platform approach to fuel exploration, and an examination of continuing programs designed to prove out the use of ERTS and other space system in exploring for fuel resources.

Author

N75-11414*# Mississippi State Univ., State College.

APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1974

W. Frank Miller, C. W. Bouchillon, J. C. Harris, Brad Carter, Frank Whisler, and Randell Robinette 31 Oct. 1974 24 p refs

(Grant NGL-25-001-054)

(NASA-CR-140805; SAPR-2) Avail: NTIS HC $3.25 CSCL 08B

The primary purpose of the remote sensing applications program is for various members of the university community to participate in activities that improve the effective communication between the scientific community engaged in remote sensing research and development and the potential users of modern remote sensing technology. Activities of this program are assisting the State of Mississippi in recognizing and solving its environmental, resource and socio-economic problems through inventory, analysis, and monitoring by appropriate remote sensing systems. Objectives, accomplishments, and current status of the following individual projects are reported: (1) bark beetle project; (2) state park location planning; and (3) waste source location and stream channel geometry monitoring.

Author

N75-11415*# Wolf Research and Development Corp., Riverdale, Md.

GEODYN SYSTEM DESCRIPTION, VOLUME 1

M. M. Chin, C. C. Goad, and T. V. Martin 30 Sep. 1972 395 p refs

(Contract NAS5-11735)

(NASA-CR-139149) Avail: NTIS HC $10.25 CSCL 08E

A computer program for the estimation of orbit and geodetic parameters is presented. The areas in which the program is operational are defined. The specific uses of the program are given as: (1) determination of definitive orbits, (2) tracking instrument calibration, (3) satellite operational predictions, and (4) geodetic parameter estimation. The relationship between the various elements in the solution of the orbit and geodetic parameter estimation problem is analyzed. The solution of the problems corresponds to the orbit generation mode in the first case and to the data reduction mode in the second case.

Author

N75-11416*# Wolf Research and Development Corp., Riverdale, Md.

GEODYN PROGRAMMER'S GUIDE, VOLUME 2, PART 2

N. E. Mullins, N. C. Dao, T. V. Martin, C. C. Goad, N. L. Boulware, and M. M. Chin Oct. 1972 276 p

(Contract NAS5-11735)

(NASA-CR-139151) Avail: NTIS HC $8.75 CSCL 08E

A computer program for executive control routine for orbit integration of artificial satellites is presented. At the beginning of each arc, the program initiates required constants as well as the variational partials at epoch. If epoch needs to be reset to a previous time, the program negates the stepsize, and calls for integration backward to the desired time. After backward integration is completed, the program resets the stepsize to the proper positive quantity.

Author

N75-11417*# Wolf Research and Development Corp., Riverdale, Md.

GEODYN OPERATIONS DESCRIPTION, VOLUME 3

Thomas V. Martin and N. Eileen Mullins 30 Sep. 1972 272 p

(Contract NAS5-11735)

(NASA-CR-139152) Avail: NTIS HC $8.50 CSCL 08E

The operating and set-up procedures for the multi-satellite, multi-arc GEODYN- Orbit Determination program are described. All system output is analyzed. The GEODYN Program is the nucleus of the entire GEODYN system. It is a definitive orbit and geodetic parameter estimation program capable of simultaneously processing observations from multiple arcs of multiple satellites. GEODYN has two modes of operation: (1) the data reduction mode and (2) the orbit generation mode.

Author

N75-11418*# Wolf Research and Development Corp., Riverdale, Md.

GEODYN SYSTEM SUPPORT PROGRAM, VOLUME 4

N. Eileen Mullins 30 Sep. 1972 362 p

(Contract NAS5-11735)

(NASA-CR-139153) Avail: NTIS HC $10.00 CSCL 08E

The GEODYN Orbit Determination and Geodetic Parameter Estimation System consists of a set of computer programs designed to determine and analyze definitive satellite orbits and their associated geodetic and measurement parameters. This manual describes the Support Programs used by the GEODYN System. The mathematics and programming descriptions are detailed. The operational procedures of each program are presented. GEODYN ancillary analysis programs may be grouped into three different categories: (1) orbit comparison - DELTA (2) data analysis using reference orbits - GEORGE, and (3) pass geometry computations - GROUNDTRACK. All of the above three programs use one or more tapes written by the GEODYN program in either a data reduction or orbit generator run.

Author

N75-11419*# Scientific Translation Service, Santa Barbara, Calif.

SPACE ICONICS

B. N. Radionov, ed., Ya. L. Ziman, ed., A. A. Izotov, ed., V. I. Pavlov, ed., T. P. Popova, ed., and Yu. M. Chesnokov, ed. Washington NASA Sep. 1974 289 p refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka

Press, 1973 240 p
(Contract NASw-2483)
(NASA-TT-F-798) Avail: NTIS HC $8.75 CSCL 14C

A broad range of questions of space iconics and iconology are covered, beginning with methodological questions and the definitions of these terms. The papers on iconology examine the questions of determining spacecraft orientation, techniques and equipment for transforming and correlating television and IR pictures of the earth, geological, geophysical, and geographical interpretation of pictures taken from space, questions of machine interpretation of cloud images obtained from space. For individual titles, see N75-11420 through N75-11445.

N75-11420* Scientific Translation Service, Santa Barbara, Calif.
ICONICS AND ICONOLOGY
B. N. Rodionov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 1-20 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 5-19
(For availability see N75-11419 02-43)
CSCL 14C

The term iconics covers the complex of methods and equipment for obtaining images, integrated on a common methodological basis. The concept combines such methods and equipment for obtaining images as photography, television, phototelevision, thermovision, and radar. The term iconics has been used previously, but in a narrower sense, as the name for the theory of image reproduction systems, primarily in the sense of their optimization. Iconics must include two branches; theoretical and practical. The system optimization problem then takes its place in theoretical iconics along with other problems. The term iconology has been proposed to cover the complex of image interpretation methods and equipment. A.L.

N75-11421* Scientific Translation Service, Santa Barbara, Calif.
PROSPECTS FOR THE DEVELOPMENT OF PHOTOTELEVISION METHODS IN SPACE STUDIES
A. S. Selivanov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 21-28 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 20-25
(For availability see N75-11419 02-43)
CSCL 14E

In-space imaging of the surface of celestial bodies can be carried out by both television and photographic equipment. Television equipment of various types has the important property of being capable of transmitting imagery in real time. Frequently this is not possible because of the nature of information transmission over the spacecraft-ground communication line. The inadequate energy handling capacity of the communication lines usually requires storage of the video information aboard the spacecraft for subsequent transmission at a definite time and rate. For this purpose, the television camera can be connected with a magnetic memory, or the television imagery may be stored on photographic film. The television/photographic film system has been termed phototelevision. The choice of a system of one type or the other is dictated by several considerations, the most important of which are the size and weight characteristics, other conditions being the same (power consumption, reliability, etc.). The advantages and disadvantages of the two systems are discussed and examples are given of types of satellites on which the two types have been employed. A.L.

N75-11422* Scientific Translation Service, Santa Barbara, Calif.
FUTURE DEVELOPMENT OF IR THERMOVISION WEATHER SATELLITE EQUIPMENT
A. V. Listratov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 29-41 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 26-36
(For availability see N75-11419 02-43)
CSCL 14C

The self radiation of the surface being viewed is used for image synthesis in IR thermovision equipment. The installation of such equipment aboard weather satellites makes it possible to obtain cloud cover pictures of the earth's surface in a complete orbit, regardless of the illumination conditions, and also provides quantitative information on the underlying surface temperature and cloud top height. Such equipment is used successfully aboard the Soviet satellites of the Meteor system, and experimentally on the American satellites of the Nimbus series. With regard to surface resolution, the present-day IR weather satellite equipment is inferior to the television equipment. This is due primarily to the comparatively low detectivity of the IR detectors used. While IR equipment has several fundamental advantages in comparison with the conventional television equipment, the problem arises of determining the possibility for future development of weather satellite IR thermovision equipment. Criteria are examined for evaluating the quality of IR. Author

N75-11423* Scientific Translation Service, Santa Barbara, Calif.
DETERMINING ICONOMETRIC PARAMETERS OF IMAGING DEVICES USING A WIDE-ANGLE COLLIMATOR
Ya. L. Ziman *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 41-47 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 36-41
(For availability see N75-11419 02-43)
CSCL 14C

The problem of determining the iconometric parameters of the imaging device can be solved if the camera being calibrated is used to obtain the image of a group of reference points, the directions to which are known. In order to specify the imaging device coordinate system, it is sufficient in principle to obtain on the picture the images of three reference points which do not lie on a single straight line. Many more such points are required in order to determine the distortion corrections, and they must be distributed uniformly over the entire field of view of the camera being calibrated. Experimental studies were made using this technique to calibrate photographic and phototelevision systems. Evaluation of the results of these experiments permits recommending collimators for calibrating television and phototelevision imaging systems, and also short-focus small-format photographic cameras. Author

N75-11424* Scientific Translation Service, Santa Barbara, Calif.
GEOMETRIC DISTORTIONS OF AUTOCOLLIMATION TYPE SCANNERS
M. K. Narayeva *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 48-51 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 42-44
(For availability see N75-11419 02-43)
CSCL 14C

One criterion of image quality is its geometric similarity to the control test. The ability of television, phototelevision, phototelegraphic, and other systems to transmit geometrically similar images is characterized by the geometric distortion coefficient. Linear distortions result from the inaccuracy of scanning mechanism element assembly, and distortions can be minimized during adjustment operations or may be easily compensated during image reception. Brief descriptions are given of the possible sources of nonlinear distortions which arise in these devices due to the scanning mechanism, objective distortion, or the nodding mirror. Author

N75-11425* Scientific Translation Service, Santa Barbara, Calif.
GEOMETRIC DISTORTIONS OF OPTICOMMERCIAL PANORAMIC TELEVISION SYSTEMS
V. M. Govorov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 51-59 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 44-51
(For availability see N75-11419 02-43)
CSCL 09F

One of the problems solvable by the spaceborne television system, topographical surveying, makes high demands on image quality, particularly on the geometric distortions introduced by the television camera. It is the geometric distortions which determine measurement accuracy and, consequently, the possibility of creating reliable planetary surface maps. Comparative analysis of the different television systems capable of solving the problem showed that the requirements on quality of the transmitted images are best satisfied by television cameras with opticomechanical scanning. The design of panoramic television systems and the process of image construction by the opticomechanical camera are discussed. Results indicate that panoramic television cameras have the necessary instrumental accuracy and permit determination of the direction to objects with an error practically equal to the resolution. Author

N75-11426* Scientific Translation Service, Santa Barbara, Calif.
FILM PROCESSING IN SCIENTIFIC SPACECRAFT TELEVISION SYSTEMS c35
G. M. Aleshin *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 59-66 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 51-56 (For availability see N75-11419 02-43)
CSCL 14E

Photography and photochemical processing of the film in spacecraft phototelevision systems involve several aspects which require an approach to selection of the handling process which differs from that used under ground conditions, different processing technology, and different construction of the instrument for carrying out the processing. Soviet processing techniques and equipment are described. Author

N75-11427* Scientific Translation Service, Santa Barbara, Calif.
REDUCTION OF IMAGE BLURRING ON INDIVIDUAL AERIAL PHOTOGRAPHS c35
Yu. I. Fivenskiy and Yu. L. Biryukov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 67-74 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 57-63 (For availability see N75-11419 02-43)
CSCL 14E

A technique is discussed for photographic reduction of blurring which utilizes only a single photograph. No special equipment which is not available in practically any photographic laboratory is required to carry out the technique. Author

N75-11428* Scientific Translation Service, Santa Barbara, Calif.
APPLICABILITY OF THE DIFFUSION APPROXIMATION c90
Yu. L. Biryukov, L. G. Titarchuk, and Yu. M. Chesnokov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 75-84 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 63-70 (For availability see N75-11419 02-43)
CSCL 03B

Several methods using an approximate form of the scattering indicatrix are discussed for simplifying the calculation of radiation transport in planetary atmospheres. Author

N75-11429* Scientific Translation Service, Santa Barbara, Calif.
SCATTERING OF LIGHT IN A SPHERICAL MULTILAYER ATMOSPHERE c74
L. G. Titarchuk *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 85-120 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 72-105 (For availability see N75-11419 02-43)
CSCL 20F

The problem of radiation diffusion in the atmosphere of a planet illuminated by solar rays was examined. The basic equations of the problem were obtained and the solution was found for the case when the absorption coefficient in the atmosphere is constant. The assumption was introduced of exponential variation of absorptivity with altitude, and a first approximation solution was proposed. Author

N75-11430* Scientific Translation Service, Santa Barbara, Calif.
ESTIMATES OF THE VENUS ATMOSPHERE OPTICAL CHARACTERISTICS WITH APPLICATION TO THE PROBLEM OF PHOTOGRAPHING ITS CLOUDS AND SURFACE c90
Yu. L. Biryukov, A. S. Fanfilov, and L. G. Titarchuk *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 121-135 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 106-117 (For availability see N75-11419 02-43)
CSCL 03B

Optical parameters investigated and solved for included: (1) cloud layer albedo and cloud cover optical thickness; (2) planetary surface self-radiation influence; (3) light flux distribution as function of atmospheric height; (4) upper estimate of the observed contrasts; (5) surface optical parameters; and (6) contrast decrease with altitude. A.L.

N75-11431* Scientific Translation Service, Santa Barbara, Calif.
DETERMINING SPACECRAFT AND AIRPLANE ANGULAR ORIENTATION FROM STAR PHOTOGRAPHS c04
K. I. Elbakyan *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 136-143 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 118-123 (For availability see N75-11419 02-43)
CSCL 17G

The advantages of determining spacecraft angular orientation from star photographs include the documental nature and objectivity of the photographic image and also the high accuracy of construction of the reference system based on the stars. Use of the method presupposes installation aboard the vehicle of a specialized photographic camera adapted for photographing the stellar sky. From the mathematical viewpoint, the essence of the method amounts to: (1) Certain directions in space are identified and their direction cosines are determined in a specified coordinate system. (2) The direction cosines of these same directions are determined relative to a coordinate system fixed with the vehicle. (3) The sought angular orientation of the vehicle is calculated using the coupling equations between the specified and vehicle-fixed coordinate systems. In principle, vehicle angular orientation can be determined relative to any given reference system. Author

N75-11432* Scientific Translation Service, Santa Barbara, Calif.
GEOGRAPHIC CORRELATION OF TELEVISION PICTURES OBTAINED FROM WEATHER SATELLITES
A. V. Bushuyev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 143-145 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 123-124 (For availability see N75-11419 02-43)
CSCL 08B

The geographical control of satellite pictures, using the terminology of aerial photography, can be treated as the problem of analysis of a single picture with the objective of obtaining a ground contour map. Studies have shown the possibility and capability of the method of composing photographic maps from transformed television pictures. Optico-mechanical transformation solves the problem of geographical correlation for operational purposes. However, this technique does not compensate for electronic distortion, and accounts for earth sphericity only approximately. However, for certain purposes (studying ice drift), the maximum possible accuracy is required. Analytic geographical correlation methods using digital computers should be considered promising. Author

N75-11433* Scientific Translation Service, Santa Barbara, Calif.
GEOGRAPHICAL CORRELATION OF TV AND IR IMAGES OBTAINED FROM WEATHER SATELLITES
Ya. L. Ziman, B. N. Nepoklonov, and B. N. Rodionov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 146-155 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 126-133 (For availability see N75-11419 02-43)
CSCL 08B

The requirements on the accuracy of geographical correlation of TV and IR cloud cover images are determined by the objective of the analysis of the weather information contained in these images. In the operational analysis case, the correlation accuracy need not be high. Errors of several tens of kilometers in determining the location of the cloud formation contours are considered acceptable in this case. Such correlation must be provided in real image reception time. Scientific studies require accurate correlation of the cloud formation contours. The errors in determining their position should be commensurate with the imaging system resolution. The geometric aspects of developing methods and equipment for geographical correlation of television and infrared images of cloud cover taken from Meteor satellites are discussed. Author

N75-11434* Scientific Translation Service, Santa Barbara, Calif.
SYSTEM FOR ELECTRONIC TRANSFORMATION AND GEOGRAPHIC CORRELATION OF SATELLITE TELEVISION INFORMATION
V. P. Dubenskiy, B. L. Nemkovskiy, and B. N. Rodionov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 155-164 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 133-140 (For availability see N75-11419 02-43)

CSCL 14E

An electronic transformation and correlation system has been developed for the Meteor space weather system which provides transformation and scaling of the original picture, accounts for satellite flight altitude and inclinations of the optical axes of the transmitting devices, and simultaneously superposes the geographical coordinate grid on the transformed picture. Author

N75-11435* Scientific Translation Service, Santa Barbara, Calif.
GEOGRAPHICAL CORRELATION OF EARTH CLOUD COVER PICTURES OBTAINED FROM UNORIENTED SATELLITES
c47

V. I. Solovyev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 165-173 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 141-146 (For availability see N75-11419 02-43)

CSCL 04B

Mathematical models have been developed for the determination of the geographic coordinates of cloud photographs taken from earth satellites. The proposed methods were realized on a Minsk-22 computer, and were used to process the earth cloud pictures obtained from the communications satellite Molyniya 1 and the automatic stations Zond 5 and 7. Experience using these methods showed that the accuracy of orientation angular element determination is on the order of 1 deg. Author

N75-11436* Scientific Translation Service, Santa Barbara, Calif.
GEOLOGICAL AND GEOPHYSICAL STUDIES FROM SPACE AND PROSPECTS FOR THEIR DEVELOPMENT

G. B. Gonin, A. I. Vinogradova, B. V. Shilin, and N. A. Yakovlev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 174-181 Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 147-152 (For availability see N75-11419 02-43)

CSCL 08G

The possibilities of using images obtained by devices which detect the reflected and self-radiation of the the earth's surface and atmosphere in other parts of the spectrum, other than visible, were analyzed. Considered were: (1) infrared; (2) radiothermal; and (3) magnetic field. A.L.

N75-11437* Scientific Translation Service, Santa Barbara, Calif.
EXPERIENCE IN INTEGRATED GEOLOGICAL AND GEOGRAPHICAL INTERPRETATION OF SPACE PHOTOGRAPHS OBTAINED IN THE USSR

B. V. Vinogradov and A. A. Grigoryev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 182-189 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 153-158 (For availability see N75-11419 02-43)

CSCL 14E

Two examples of regional interpretation of imagery acquired from satellite photographic and television systems are discussed. The imagery was taken aboard the Zond 7 and Kosmos satellites, and depicted; (1) sand and dust storm activity in the eastern Mediterranean Sea area; and (2) landscape and structural properties of territory of southwestern United States and northwestern Mexico. A.L.

N75-11438* Scientific Translation Service, Santa Barbara, Calif.
USE OF TV PICTURES OBTAINED FROM WEATHER SATELLITES TO STUDY THE GEOLOGICAL STRUCTURE OF THE EARTH

I. I. Bashilova *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 190-194 Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 159-162 (For availability see N75-11419 02-43)

CSCL 08G

Results are presented of Soviet investigations into the use of television imagery obtained from meteorological satellites for the interpretation of tectonics, lithology, and structural properties of the earth. The area investigated encompassed the eastern part of Iran, and the western regions of Afghanistan and Pakistan. Interpretation of the features identified during the analysis was accomplished by comparing these features with physical, geographic, geological, and tectonic maps. It was concluded that television pictures of the earth from space can be used for geological and structural analysis. A.L.

N75-11439* Scientific Translation Service, Santa Barbara, Calif.
GLOBAL SMALL-SCALE LUNAR CARTOGRAPHY

Yu. N. Lipskiy, Yu. P. Pskovskiy, Zh. F. Rodionova, V. V. Shevchenko, V. I. Chikmachev, and L. I. Volchkova *In its* Space Iconics (NASA-TT-F-798) Sep. 1972 p 195-204 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 163-168 (For availability see N75-11419 02-43)

CSCL 08B

The primary sources information for compiling this map were the photographs of the visible hemisphere obtained by earth-based observatories, the Luna 3 and Zond 3 pictures, and a small number of Lunar Orbiter pictures. The primary content of the complete lunar map is the surface relief and its tonal characteristics. In preparing the map, particular attention was devoted to the variety of lunar relief forms. The color spectrum of the map was selected not only for the natural coloring of the lunar surface, but also with the objective of achieving maximum expressiveness. A lunar globe to scale 1:10 million was prepared along with the preparation of the map. The scale of the globe, half that of the map, led to some selection and generalization of the relief forms. The globe permits maintaining simultaneously geometric similarity of contours, exact proportions of areas, and identical scales in all directions. The globe was prepared in both the Latin and Russian languages. A.L.

N75-11440* Scientific Translation Service, Santa Barbara, Calif.
IDENTIFICATION CHARATERISTICS OF CERTAIN LUNAR RELIEF FORMS ON PICTURES OBTAINED FROM SPACECRAFT

V. I. Kravtsova *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 205-215 Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 169-178 (For availability see N75-11419 02-43)

CSCL 03B

This investigation was restricted to the determination of recognitional characteristics of a single type of relief form, dimple craters on the surface of maria. These craters were arbitrarily considered as closed, negative relief forms, circular in plan-view, and symmetric relative to the center. Two techniques were used to determine the shadow configuration in the craters: (1) experimental determination of the shadow edge by illuminating the models of different profile shapes with a parallel light beam; and (2) geometric construction of the shadow edge using a vertical section of the formation in the direction of the solar rays. A morphological map of the surface which includes the following factors can be compiled using the proposed identification technique: crater profile nature, crater diameter, ratio of diameter and depth, sharpness of the lip, and distribution density of the forms. A.L.

N75-11441* Scientific Translation Service, Santa Barbara, Calif.
ON THE DETERMINATION OF CERTAIN ASTRONOMICAL, SELENODESIC, AND GRAVITATIONAL PARAMETERS OF THE MOON

Ye. P. Aleksashin, Ya. L. Ziman, I. V. Isavnina, V. A. Krasikov, B. V. Nepoklonov, B. N. Rodionov, and A. P. Tischenko *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 215-231 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 179-190 (For availability see N75-11419 02-43)

CSCL 03B

A method was examined for joint construction of a selenocentric fundamental system which can be realized by a coordinate catalog of reference contour points uniformly positioned over the entire lunar surface, and determination of the parameters characterizing the gravitational field, rotation, and orbital motion of the moon. Characteristic of the problem formulation is the introduction of a new complex of inconometric measurements which can be made using pictures obtained from an artificial lunar satellite. The proposed method can be used to solve similar problems on any other planet for which surface images can be obtained from a spacecraft. Characteristic of the proposed technique for solving the problem is the joint statistical analysis of all forms of measurements: orbital iconometric, earth-based trajectory, and also a priori information on the parameters in question which is known from earth-based astronomical studies. Author

N75-11442* Scientific Translation Service, Santa Barbara, Calif.
EVALUATING THE ACCURACY OF SELENODESIC REFERENCE GRIDS
A. A. Koptev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 231-245 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 191-202 (For availability see N75-11419 02-43)
CSCL 08B

Estimates were made of the accuracy of reference point grids using the technique of calculating the errors from theoretical analysis. Factors taken into consideration were: telescope accuracy, number of photographs, and libration amplitude. To solve the problem, formulas were used for the relationship between the coordinates of lunar surface points and their images on the photograph. Author

N75-11443* Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF DYNAMIC CORRECTIONS TO POINT COORDINATES OF PHOTOGRAPHS OBTAINED BY THE ZOND 6 AND ZOND 8 SPACECRAFT
V. V. Kiselev and B. N. Rodionov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 245-257 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 204-212 (For availability see N75-11419 02-43)
CSCL 14E

The linear and angular motions of the Zond 6 and Zond 8 spacecraft imaging camera during the exposure cause displacements of the optical image points. In the case of instantaneous exposure of each individual point and the nonsimultaneous exposure of the complete frame, this leads to finite geometric shifts of the points without causing blurring of the photographic image. Therefore, when measuring the resulting photographic pictures, the problem arises of reducing the picture point positions to a common instant of time. This reduction is performed by means of dynamic corrections to the measured picture point coordinates. These corrections are found by using formulas of dynamic photogrammetry. Their use with the Zond space probe photographs is described. Author

N75-11444* Scientific Translation Service, Santa Barbara, Calif.
REFINEMENT OF THE GOLOSEYEV CATALOG POINT COORDINATES IN THE LIMB ZONE AND DETERMINATION OF POINT COORDINATES ON THE BACK SIDE OF THE MOON
V. A. Krasikov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 257-272 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 213-224 (For availability see N75-11419 02-43)
CSCL 03B

Lunar photography from Zond 6 showed half the side of the moon which is not visible from the earth and this made it possible to construct a photogrammetric grid encompassing the entire Western Hemisphere and referenced to points of the visible side, whose coordinates were taken from the Goloseyev catalog. The problem was solved using two pictures taken from approximately 9000 km above the lunar surface. The photogrammetric grid was constructed by joint statistical analysis of the measurements of both pictures and the selenographic coordinates of the catalog points. A special algorithm was developed and a program compiled realizing the maximum likelihood method which permitted working with up to 120 catalog points simultaneously. A.L.

N75-11445* Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF SELENOGRAPHIC COORDINATES OF LUNAR SURFACE POINTS FROM SINGLE PICTURES OBTAINED FROM ZOND 6
Ya. L. Ziman, V. F. Baratova, and I. V. Isavnina *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 272-282 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 225-233 (For availability see N75-11419 02-43)
CSCL 03B

Pictures of the lunar surface with an image of practically the entire lunar limb were obtained from the Zond 6 spacecraft. During the time of exposure, the entire lunar surface covered by these photographs was illuminated by the sun. Such single pictures were used to find the external orientation elements and selenographic coordinates of the photographed lunar surface points. The selenographic coordinate system was specified by the Goloseyev catalog and was realized by points of this catalog identified on the pictures and termed reference points. Craters located on the invisible side of the moon and also other points of the Goloseyev catalog, which could be used as control points, were taken as the points being determined. The technique used to compute the selenographic coordinates of the points is outlined. Author

N75-11446*# Research Triangle Inst., Research Triangle Park, N.C. Engineering Div.
STUDY OF THE USE OF METAL-OXIDE-SILICON (MOS) DEVICES FOR PARTICULATE DETECTION AND MONITORING IN THE EARTH'S ATMOSPHERE
A. D. Brooks, L. K. Monteith, J. J. Wortman, and J. C. Mulligan Nov. 1974 85 p refs
(Contract NAS1-12714; RTI Proj. 43U-929)
(NASA-CR-132518) Avail: NTIS HC $4.75 CSCL 14B

A metal-oxide-silicon (MOS) capacitor-type particulate sensor was evaluated for use in atmospheric measurements. An accelerator system was designed and tested for the purpose of providing the necessary energy to trigger the MOS-type sensor. The accelerator system and the MOS sensor were characterized as a function of particle size and velocity. Diamond particles were used as particulate sources in laboratory tests. Preliminary tests were performed in which the detector was mounted on an aircraft and flown in the vicinity of coal-fired electric generating plants. Author

N75-11447*# Rice Univ., Houston, Tex. Inst. for Computer Services and Applications.
AN ANALYSIS OF APPLICATIONS DEVELOPMENT SYSTEMS FOR REMOTELY SENSED, MULTISPECTRAL DATA FOR THE EARTH OBSERVATIONS DIVISION OF THE NASA LYNDON B. JOHNSON SPACE CENTER
D. L. VanRooy, R. M. Smith, and M. S. Lynn Feb. 1974 127 p
(Contract NAS9-12776)
(NASA-CR-140345; Rept-275-025-018) Avail: NTIS HC $5.75 CSCL 05B

An application development system (ADS) is examined for remotely sensed, multispectral data at the Earth Observations Division (EOD) at Johnson Space Center. Design goals are detailed, along with design objectives that an ideal system should contain. The design objectives were arranged according to the priorities of EOD's program objectives. Four systems available to EOD were then measured against the ideal ADS as defined by the design objectives and their associated priorities. This was accomplished by rating each of the systems on each of the design objectives. Utilizing the established priorities, it was determined how each system stood up as an ADS. Recommendations were made as to possible courses of action for EOD to pursue to obtain a more efficient ADS. Author

N75-11448# Bendix Corp., Kansas City, Mo.
RESOURCES FORECASTING SYSTEM Technological Spinoff Report
J. J. Kolich Mar. 1974 43 p
(Contract AT(29-1)-613)
(BDX-613-1078) Avail: NTIS HC $3.75

A system is described for use by management in forecasting the manpower, machines, material, tools, gages, test equipment, and floor space required to support current schedules and planned or contemplated production. An automated Resources Forecasting System (RFS) is now being used in a manufacturing operation involving 2400 products, representing 25,000 different parts and 175,000 production operations. The system is applied to product categories including electrical and electronic, plastics and rubber, mechanical, and electromechanical. All customer order requirements are consolidated into piece part or assembly schedules for production and procurement activities: completed piece parts and assemblies are then allocated to customer orders on a shipment priority basis. The system is designed to accommodate multiple product definitions and changing schedule requirements. It reduced the time required to produce manpower and machine forecasts for budgeting exercises from 36 to 10 days, and for

monthly forecasts from 23 to 5 days. The period which can be forecasted was extended from 2-1/2 years to 10 years. Author

N75-11449# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
THORIUM, URANIUM, OTHER METALS AND MATERIALS FROM EARTH'S CRUST ROCKS
M. Taube Apr. 1974 33 p ref
(EIR-252) Avail: AEC Depository Libraries HC $4.75

The general use is discussed of the rocks of the earth's crust as a source of nuclear energy (from thorium-uranium extracted with 30% efficiency), and a source of metals (aluminium, iron, etc.), a source of ceramics (cement, glass, quartz) and other materials. The use of this source is proposed to meet the needs of a future stable civilization requiring a unit power production of some 20 kW per capita and source material supply of 1 ton per capita per year (additional to recycling). The impact of this on the philosophy of reactor development is also discussed. Author (NSA)

N75-11450# Army Foreign Science and Technology Center, Charlottesville, Va.
USE OF A PANORAMIC AERIAL CAMERA IN AEROSURVEYING
M. D. Konshin 25 Apr. 1974 9 p Transl. into ENGLISH from Geod. Kartografiya (USSR), no. 1, 1973 p 33-36
(AD-784162; FSTC-HT-23-0160-74) Avail: NTIS CSCL 08/2

The use of a panoramic aerial camera when carrying out aerial surveys is discussed. The photographic quality of the image is better due to the use of an exposure time of 1/3000 sec. The amount of field interpretation will be reduced and labor productivity will be increased by using the method suggested. GRA

N75-11451# Army Engineer Topographic Labs., Fort Belvoir, Va.
SPECTRAL/SPATIAL RESOLUTION TARGETS FOR AERIAL IMAGERY
Robert K. Brooke, Jr. Mar. 1974 25 p
(DA Proj. 4A0-62112-A-854)
(AD-784090; ETL-TR-74-3) Avail: NTIS CSCL 08/2

A set of aerial spectral/spatial resolution targets was designed and fabricated by the U. S. Army Engineer Topographic Laboratories (USATEL) for use in the USAETL Color and Multiband Test Program. Three-bar resolution targets consisting of color bars on a neutral background and a 10-step gray scale make up the test pattern. Special paints were formulated to achieve the desired spectral reflectance characteristics, and the targets were sectioned for transporting to various test sites. Author (GRA)

N75-11452# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIENCE GAINED IN PREPARATION OF PHOTOMAPS BY THE OPTICAL MONTAGE METHOD
A. E. Galkin and B. I. Sergeev 22 Feb. 1974 12 p Transl. into ENGLISH from Geod. Kartografiya (USSR), no. 8, 1972 p 31-35
(AD-784042; FSTC-HT-23-1835-73) Avail: NTIS CSCL 08/2

A study was conducted of the methods being tested for producing large-scale photographic maps, using the optical montage technique. A detailed report of the optical montage process is given. A comparison of time and money spent on this process, compared with the one previously used, is made, showing the economy in the new system. GRA

N75-11453# Army Foreign Science and Technology Center, Charlottesville, Va.
USE OF A DIGITAL COMPUTER TO CONSTRUCT ISOLINE MAPS BASED ON A STEREOMODEL OF TERRAIN
V. M. Zaitsev, V. S. Lavrova, and A. A. Chigirev 18 Apr. 1974 12 p refs Transl. into ENGLISH from Geodeziya i Kartografiya (USSR), no. 4, 1973 p 48-53
(AD-784170; FSTC-HT-23-0278-74) Avail: NTIS CSCL 08/5

A new method of constructing isolines in accordance with an altitude matrix given within the nodes of a grid is proposed. The algorithm for this method was applied in a subsystem including an input device, a control digital computer, and an output device. If a Dnepr-1 computer is used, all the isolines on a map measuring 200 x 300 mm with a 0.2 mm stride can be plotted in about 3 hours, but the time can be shortened by several times if more highly advanced equipment is used. GRA

N75-11454# Texas Instruments, Inc., Dallas. Equipment Group.
OIL-ON-WATER SENSOR Final Engineering Report
Kent McCormack, Gerald Fournier, and William Knight Feb. 1974 206 p refs
(Contract DOT-CG-31888-A)
(AD-784104; TI-UI-998200-01-F; USCG-D-87-74) Avail: NTIS CSCL 17/5

The Oil-on-Water Sensor system detects the presence of oil on water by emitting a wideband IR pulse and receiving reflections at two narrow spectral bands. Theory of operation is based on dgferences in the reflectance of water and oil at these narrow spectral bands. Ratio detection minimizes effects of surface wave action. This final report explains the principles of sensing, describes and explains the prototype equipment, and describes construction details of the Oil-on-Water Sensor. Finally, the report outlines the testing program that was used and provides data from these tests. Author (GRA)

N75-11562* Oxford Univ. (England). Clarendon Lab.
INFRARED REMOTE SOUNDING
C. D. Rodgers *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 471-506 refs (For availability see N75-11549 02-46)
CSCL 04A

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N75-11455# Committee on Interior and Insular Affairs (U. S. House).
OIL SHALE DEVELOPMENT, PART 2
Washington GPO 1974 130 p Hearings before Subcomm. on Mines and Mining of Comm. on Interior and Insular Affairs, 93d Congr., 2d Sess., 25-26 Feb. 1974
(GPO-30-368) Avail: Subcomm. on Mines and Mining

Information was provided to Congress concerning plans for exploration and production of oil from shale, including such factors as lease arrangements, domestic abundance of oil shale, projected development costs, and efficiency of currently available extraction processes. The probable contribution of oil shale development to plans for U. S. energy self-sufficiency was also assessed. A.A.D.

N75-11456*# Boeing Aerospace Co., Seattle, Wash. Nuclear and Space Physics Dept.
RESEARCH STUDY ON HIGH ENERGY RADIATION EFFECT AND ENVIRONMENT SOLAR CELL DEGRADATION METHODS Final Report
W. E. Horne and M. C. Wilkinson 24 Oct. 1974 48 p refs (Contract NAS8-30378)
(NASA-CR-120519; D180-18475-1) Avail: NTIS HC $3.75 CSCL 10A

The most detailed and comprehensively verified analytical model was used to evaluate the effects of simplifying assumptions on the accuracy of predictions made by the external damage coefficient method. It was found that the most serious discrepancies were present in heavily damaged cells, particularly proton damaged cells, in which a gradient in damage across the cell existed. In general, it was found that the current damage coefficient method tends to underestimate damage at high

fluences. An exception to this rule was thick cover-slipped cells experiencing heavy degradation due to omnidirectional electrons. In such cases, the damage coefficient method overestimates the damage. Comparisons of degradation predictions made by the two methods and measured flight data confirmed the above findings. Author

N75-11457# Bureau of Natural Gas, Washington, D.C. Office of Economics.
OFFSHORE INVESTIGATION: PRODUCIBLE SHUT-IN LEASES, JANUARY 1974, PHASE 1
Mar. 1974 60 p
Avail: NTIS HC $4.25

Information was gathered concerning federal oil and gas leases in the offshore Louisiana and Texas areas classified by the U. S. Geological Survey as "producible shut-in." Results indicate that a total of 168 leases are classified as producible shut-in. The estimated potential hydrocarbon production of these leases is discussed along with reasons for the numerous extensions of shut-in lease terms. Author

N75-11458# Bureau of Natural Gas, Washington, D.C.
OFFSHORE INVESTIGATION: PRODUCIBLE SHUT-IN LEASES AS OF JANUARY 1974, PHASE 2
Jul. 1974 30 p Original contains color illustrations
Avail: NTIS HC $3.75

Estimates were made of the proved and probable gas reserves underlying the producible shut-in leases of the Louisiana and Texas Outer Continental Shelf. Data from the files of the U.S. Geological Survey and the Federal Power Commission were used. Results are summarized in tabular form. Author

N75-11459*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR SEA POWER PLANTS (SSPP): A CRITICAL REVIEW AND SURVEY
Alvin M. Strauss (Cincinnati Univ.) Sep. 1974 76 p refs Proposed for presentation at Intern. Solar Energy Soc. Intern. Conf., Los Angeles, Jul. 1975 Submitted for publication
(NASA-TM-X-70783; X-704-74-277) Avail: NTIS HC $4.75 CSCL 10A

An overview of technical and economic matters relating to the eventual success or failure of the SSPP concept is presented, with emphasis on the pollution and energy problems which the SSPP would serve to eliminate. Factors discussed include cost, mariculture possibilities, siting, legal limitations, design materials, mooring and anchoring, and the human element involved. Several alternative power systems are considered for incorporation into SSPP design, such as Nitinol power, Claude cycle, and closed cycle engine systems. A.A.D.

N75-11460# Bureau of Mines, San Francisco, Calif. Energy Research Lab.
SOLVENT STIMULATION TESTS IN TWO CALIFORNIA OILFIELDS
H. J. Lechtenberg, G. L. Gates, W. H. Caraway, and O. C. Baptist 1974 27 p refs
(BM-RI-7978) Avail: NTIS HC $3.75

The Bureau of Mines investigated solvent injection as a means of increasing oil production from low gravity oil fields. The wells were either allowed to soak or the solvent was circulated for a period of time. In some of the wells, the solvent was followed by a slug of water. Wells in which the solvent was not followed by water showed an immediate increase in oil production. The wells in which solvent was followed by water essentially showed a delay in the increase in oil production, thus indicating a temporary water block. The results show that the production rate is usually increased by the injection of solvent, and the method may prevent early abandonment of marginal producers. Cumulative post stimulation oil production indicates that cyclic solvent injection treatment can be an economic success. Author

N75-11461# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
METHANE IN THE PITTSBURGH COALBED, WASHINGTON COUNTY, PENNSYLVANIA
Ann G. Kim 1974 20 p refs
(BM-RI-7969) Avail: NTIS HC $3.25

Methane in coal constitutes a serious hazard during mining. Draining the methane from large blocks of coal in advance of mining is an effective method of improving the safety and efficiency of coal mining. The similarity of the two gases permits drained methane to be recovered and added to pipeline supplies of natural gas. The effective application of advanced drainage techniques to recover drained gas depends on a gross estimate of the methane content of coal. The virgin reserves of the Pittsburgh coal in the central and southwestern parts of Washington County, Pa., are estimated at over 1.5 billion tons, with a methane content of 50 to 100 cu ft/ton. The Pittsburgh bed in this area of approximately 265 sq mi contains over 130 billion cu ft of methane. Author

N75-11462# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
DEGASIFICATION OF THE MARY LEE COALBED NEAR OAK GROVE, JEFFERSON COUNTY, ALABAMA, BY VERTICAL BOREHOLE IN ADVANCE OF MINING
C. H. Elder and Maurice Deul 1974 25 p refs
(BM-RI-7968) Avail: NTIS HC $3.25

A 5-hole pattern was drilled from the surface at a site near Oak Grove, Jefferson County, Ala., to degasify the gassy Mary Lee coalbed in advance of mining. Gas and water production was monitored for 1 year, 4 months to allow gas flow to stabilize fully. A thickened water stimulation treatment was designed and applied in one hole of the pattern to evaluate this degasification technique for the Mary Lee coalbed. A gas production rate of 70,000 ft 3/day after stimulation treatment indicates that the use of vertical boreholes coupled with hydraulic fracturing in advance of mining the Mary Lee coalbed would provide for more rapid degasification and could provide a possible source of natural gas. Author

N75-11463# Committee on Science and Astronautics (U. S. House).
BIOCONVERSION
Washington GPO 1974 430 p refs Hearing before Subcomm. on Energy of Comm. on Sci. and Astronaut., 93d Congr., 2d Sess., No. 40, 13 Jun. 1974
(GPO-37-403) Avail: Subcomm. on Energy

The conversion of solar energy and solid waste energy into useable fuels by processes collectively known as bioconversion was discussed in a Congressional hearing whose purpose was to examine alternative methods of producing energy that are efficient and cost effective. The techniques and apparatus needed for bioconversion operations are explained, and a system for methane recovery and fertilizer production from garbage and sewage is offered as an example. The marketability of fuels derived from solid waste, as well as the economic factors associated with solar energy conversion and use were also assessed. A.A.D.

N75-11464# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
IN SITU COMBUSTION OF COAL FOR ENERGY Technical Progress Report
Robert F. Chaiken Nov. 1974 15 p refs
(BM-TPR-84) Avail: NTIS HC $3.25

A concept of efficient thermal energy generation through the in situ combustion of coal and the on site conversion of that energy to electricity is discussed and shown to offer distinct advantages in the utilization of U. S. coal reserves. Analysis of data from previous underground coal gasification projects suggests that coal can be efficiently burned underground and that the burning process should be maintainable for time periods sufficient to power a commercial electricity generation plant. Analyses describing some of the requirements of a 100 megawatt (thermal) in situ combustor are also presented, and several design possibilities are suggested. Author

N75-11465# Princeton Univ., N.J. Dept. of Chemical Engineering.
UTILIZATION OF PLASMA EXHAUST ENERGY FOR FUEL PRODUCTION
J. D. Fish and R. C. Axtmann 1973 24 p refs Sponsored by AEC

(COO-3028-7) Avail: NTIS HC $3.25

The plasma exhausts from fusion reactors represent a source of high-grade energy which might be utilized to produce chemical fuels via endothermic reactions. This article examines electrolytic, radiolytic and photolytic processes in terms of the energy required to produce a mole of hydrogen gas from the dissociation of water. The results indicate that while electrolysis is not clearly superior from the standpoint of energetics, practical consideration would probably preclude the use of the other schemes.

Author (NSA)

N75-11466# California Univ., Livermore. Lawrence Livermore Lab.

REVIEW OF DIRECT ENERGY CONVERSION OF ION BEAMS: EXPERIMENTAL RESULTS AND REACTOR APPLICATIONS

R. W. Moir 2 Apr. 1974 18 p refs Presented at Meeting on Technol. of Controlled Nucl. Fusion, San Diego, Calif., 16-18 Apr. 1974 Sponsored by AEC

(UCRL-75600; Conf-740402-23) Avail: NTIS HC $3.25

In order to produce neutral beams for fusion reactors efficiently, the energy carried by the unneutralized portion of the ion beam may have to be recovered in a direct converter. Several concepts applicable to beam direct conversion are discussed. The concept that has received the most attention uses planar sets of grids. One experimental test with a hydrogen ion beam at 2 keV and 0.1 W/sq cm gave an efficiency of 95%. Another experiment at 20 keV and 200 W/sq cm was limited by gas-pressure effects to about 70% efficiency. The loss mechanisms and such design constraints as power density, space charge, and secondary electron emission are discussed.

Author (NSA)

N75-11467# California Univ., Livermore. Lawrence Livermore Lab.

SHALLOW SOLAR POND ENERGY CONVERSION SYSTEM: AN ANALYSIS OF A CONCEPTUAL 10-MWe PLANT

A. F. Clark, J. A. Day, W. C. Dickinson, and L. F. Wouters 25 Jan. 1974 31 p refs Revised

(Contract W-7405-eng-48)

(UCRL-51533-Rev-1) Avail: NTIS HC $3.75

A shallow solar pond system appears to be the most cost effective way to produce large scale electric power from solar energy. Water is used both for heat collection and heat storage. Inexpensive layers of weatherable transparent plastic over the water supress heat loss to the environment. The hot water is stored in an insulated reservoir at night and during bad weather. The stored hot water heats a thermodynamic fluid, such as Freon 11, which drives a turbine and an electric generator. A shallow solar pond system can be built using materials, fabrication techniques, and geometrics that are presently used on a large scale in U. S. industry. A 10 MWe plant built in the Southwest would require a total area of about 2.5 sq km and could provide power for a community or a manufacturing process. The estimated busbar cost of electricity (in 1973 dollars) for a shallow solar pond system, which could become on line in as short a time as 5 to 7 years, is 27 mills/kWh. It is projected that this cost could be reduced by almost half with the development of improved and cheaper plastics and more efficient turbines. Author (NSA)

N75-11468# Los Alamos Scientific Lab., N.Mex.

APPLICATION OF TECHNOLOGY FROM THE ROVER PROGRAM AND RELATED DEVELOPMENTS

R. E. Schreiber Apr. 1974 11 p

(Contract W-7405-eng-36)

(LA-5558) Avail: NTIS HC $3.25

The history of the Rover and UHTREX programs is reviewed with particular emphasis on the development of technology which could be applied to present energy needs. The existing capabilities are briefly described and two specific applications, process heat production and self-contained power and propulsion plants, are presented as examples of substantial promise for immediate work. Author (NSA)

N75-11469# Oak Ridge National Lab., Tenn.

NSF-RANN ENERGY ABSTRACTS. A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH, VOLUME 2, NO. 4

M. P. Guthrie, ed. Apr. 1974 42 p

(Contract W-7405-eng-26; Grant NSF AG-398)

(ORNL-EIS-74-52-Vol-2-4) Avail: NTIS HC $3.75

Citations with abstracts are given for 94 publications covering energy sources, electric power, and energy production. Articles on economics, supply-demand, environmental effects, policy, management, and research are included. NSA

N75-11470# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.

TECHNOLOGICAL AND COMMERCIAL POSSIBILITIES WHICH RESULT BY USING A HIGH TEMPERATURE REACTOR FOR THE FUTURE SUPPLY OF MINERAL OIL IN THE FRG

H. G. Eickhoff Nov. 1973 88 p refs In GERMAN; ENGLISH summary

(JUL-1017-RG) Avail: AEC Depository Libraries HC $7.50

An analysis of the total fossil energy resources in the world and a comparison with future requirements shows very clearly that nuclear reactors have to be applied to save the available reserves of oil. Technological efforts and commercial possibilities of high temperature nuclear process heat in the FRG are shown till the year 2000. The increasing environmental burden (especially the SO2-emission) caused by burning fossil fuel was considered in particular. This is followed by an examination of the processes which enable the production of synthetic liquid hydrocarbons if the reserves of oil are exhausted. To make a statement about the costs which arise by coupling nuclear process heat to endothermal processes, quantity balances and energy balances have been set up. The possible process configurations of the coupling assembly HTR-conversion process are shown in the flow sheets. It was possible to show that the introduction of the new technologies in oil processing requires the availability of cheap hydrogen. NSA

N75-11471# Avco-Everett Research Lab., Everett, Mass.

STATUS REPORT OF THE DESIGN STUDY ANALYSIS AND THE DESIGN OF A 10 MW COMPACT MHD GENERATOR SYSTEM Interim Technical Report

O. K. Sonju, J. Teno, R. Kessler, L. Lontai, and D. Meader Jun. 1974 315 p refs

(Contract F33615-71-C-1456; AF Proj. 3145)

(AD-783824; AFAPL-TR-74-47-Pt-2; ITR-2) Avail: NTIS CSCL 10/2

The Second Interim Report - Part 2 presents the results of a design analysis and design of a very compact high performance, 10 MW MHD generator system. The basis for this work has been firmly established by past MHD research and development programs including the most recent MHD Research and Development work reported in this Second Interim Report - Part 1. The system being designed has a target dry weight for the total system of 1800 to 2200 kg. The design analysis and a study of fabrication techniques have led to novel designs for the components of the 10 MW MHD generator system which are reviewed in detail in the report. Author (GRA)

N75-11472# Aerospace Corp., El Segundo, Calif. Lab Operations.

ELECTROPHORETIC MOBILITIES OF CADMIUM HYDROXIDE, NICKEL HYDROXIDE, AND SILVER OXIDE IN NiCd AND Ag-Zn BATTERY ELECTROLYTES Interim Report

Stanley W. Mayer 5 Jul. 1974 16 p refs

(Contract F04701-74-C-0075)

(AD-783853; TR-0075(5270-10)-1; SAMSO-TR-74-163) Avail: NTIS CSCL 07/4

Cadmium migration damage of separators is a major cause of Ni-Cd battery failures or performance degradation. A series of electrophoretic mobility measurements has been made for cadmium hydroxide suspensions in concentrated KOH battery electrolyte at several concentrations of K2CO3 to investigate whether electrophoresis of cadmium hydroxide could be the mechanism for migration to separators. It was found that the mobility of the cadmium hydroxide suspension in an applied electrical field is adequate to account for the observed migration of cadmium hydroxide to separators. The view that high carbonate concentrations in Ni-Cd battery electrolyte may increase cadmium migration damage of separators is consistent with these electrophoretic measurements. Zeta potentials have been calculated from the data. Similar measurements have been made

for nickel hydroxide suspensions in Ni-Cd battery electrolyte at several K2CO3 concentrations. The results are consistent with ion probe analyses for nickel in nylon separators exhibiting considerable cadmium migration. Silver oxide mobility was also measured. (Modified author abstract) Author (GRA)

N75-11473# Tyco Labs., Inc., Waltham, Mass.
HYDROGEN-NICKEL REGENERATIVE FUEL CELLS Final Report, May 1973 - Feb. 1974
L. Swette and G. L. Holleck Apr. 1974 81 p
(Contract F33615-73-C-2057; AF Proj. 3145)
(AD-784902; C-339; AFAPL-TR-74-19) Avail: NTIS CSCL 10/3

Tyco Laboratories designed, built, and tested six 50-Ahr Ni-H2 cells to determine the applicability of the Ni-H2 system as electrical energy storage device for satellites. Five Ni-H2 cells were of boiler plate design and one cell was a demountable quasi-light weight unit. Electrochemical components of the final design were successfully pretested in demountable 10 Ahr cells for 800 cycles. Results are discussed. (Modified author abstract) GRA

N75-11474# General Electric Co., Philadelphia, Pa. Space Div.
INVESTIGATION OF A NONEQUILIBRIUM MHD GENERATOR Annual Report, 1 Aug. 1973 - 31 Jul. 1974
B. Zauderer Aug. 1974 31 p refs
(Contract N00014-73-C-0039)
(AD-785077) Avail: NTIS CSCL 10/2

This report presents the results obtained during the past year in the study of the non-equilibrium MHD generator. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N75-11475# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air and Waste Management.
STATE AIR POLLUTION IMPLEMENTATION PLAN Progress report, 1 Jan. - 30 Jun. 1974
Sep. 1974 120 p refs
(EPA-450/2-74-013) Avail: NTIS HC $5.25

Plans for attainment of national ambient air quality standards were submitted by all States. Progress toward implementing those plans from January to June 1974 is reported. Of the 52 plans still having deficiencies, 38 have only regulatory deficiencies, which were corrected by EPA promulgation, and 14 are being finalized by State or EPA action. The adequacy of air monitoring networks and air quality data reporting is reviewed. The status of EPA enforcement activities is discussed. Compliance schedules were developed for most major point source facilities, and these schedules are being monitored and enforced. The plan revision management system, which identifies possible deficiencies in the attainment of air quality standards, was expanded to cover 117 air quality control regions, representing approximately 79 percent of the nation's population. States have identified areas with the potential of exceeding any national standard within the next 10 years, and air quality maintenance areas have been established for most such areas. Author

N75-11476# World Meteorological Organization, Geneva (Switzerland).
OBSERVATION AND MEASUREMENT OF ATMOSPHERIC POLLUTION
1974 675 p refs Partly in ENGLISH, FRENCH and SPANISH Proc. of the TECOMAP Conf., Helsinki, 30 Jul. - 4 Aug. 1973; sponsored in part by the World Health Organ.
(WMO-368; Rept-3; ISBN-92-63-10368-2) Avail: NTIS HC $15.25

Papers are presented on: requirements for measurement of air pollutants for forecasting of pollution potential; measurement and analysis of pollutants on urban, regional, and global scales; turbidity and radiation measurement as indicators of pollution; and method of standardization and intercomparison. For individual titles, see N75-11477 through N75-11540.

N75-11477 World Meteorological Organization, Geneva (Switzerland).
THE REQUIREMENTS OF THE WORLD METEOROLOGICAL ORGANISATION FOR MEASUREMENTS OF ATMOSPHERIC POLLUTANTS
Christian Junge (Intern. Union of Geodesy and Geophys.) *In its* Observation and Meas. of Atmospheric Pollution 1974 p 1-13 (For availability see N75-11476 02-45)

The interest of the WMO in atmospheric pollutants is briefly noted, and the atmospheric constituents monitored on a regional and global basis are reviewed. Considerations leading to the establishment of a pollution monitoring network are discussed. ERSO

N75-11478 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF AIR POLLUTION IN URBAN AREAS: THE WHO INTERNATIONAL AIR MONITORING NETWORKS
Graham Cleary (World Health Organ.) *In its* Observation and Meas. of Atmospheric Pollution 1974 p 14-23 (For availability see N75-11476 02-45)

The need for comprehensive monitoring programs on environmental pollution is stressed, and the objectives of the WHO monitoring program are outlined. The duration and type of monitoring are reviewed, and an epidemilogical basis for monitoring certain pollutants is given. Analytical methods of air sampling are described and the processing of air quality data briefly mentioned. ESRO

N75-11479 World Meteorological Organization, Geneva (Switzerland).
AIR QUALITY MANAGEMENT ACTIVITIES IN THE PROGRAMME OF THE WHO REGIONAL OFFICE FOR EUROPE
Michael J. Suess (World Health Organ.) *In its* Observation and Meas. of Atmospheric Pollution 1974 p 24-30 (For availability see N75-11476 02-45)

The WHO long-term program for air pollution control is described. Manuals on air quality management and industrial air pollutants and the project on long-term effects on health are considered. Air pollution control programs being implemented in six European countries are also described. ESRO

N75-11480 World Meteorological Organization, Geneva (Switzerland).
THE LONG RANGE TRANSPORT OF AIR POLLUTANTS. A COOPERATIVE TECHNICAL PROGRAMME OF OECD
B. Ottar (Organ. for Econ. Co-operation and Develop.) *In its* Observation and Meas. of Atmospheric Pollution 1974 p 31-38 refs (For availability see N75-11476 02-45)

The extent to which long range transport of air pollutants, in particular sulfur dioxide and sulfuric acid, takes place within Europe to cause detrimental effects is discussed. The project is based on an emission survey which is described together with the measurement and data evaluation programs. ESRO

N75-11481 World Meteorological Organization, Geneva (Switzerland).
INTERCOMPARISON OF AIR FILTER MEASUREMENTS
O. Suschny (IAEA) *In its* Observation and Meas. of Atmospheric Pollution 1974 p 39-48 refs (For availability see N75-11476 02-45)

An intercomparison of air filters loaded with radioactive contaminants is traced, and the intercomparisons of low-level radionuclide measurements during 1968/69 and intermediate-level during 1972 are described. The intercomparison of stable element determination in 1972 is also discussed. An overall evaluation suggests that a continued system of analytical quality control is considered necessary to permit an assessment of the reliability of results obtained in air filter measurements. ESRO

N75-11482 World Meteorological Organization, Geneva (Switzerland).
AGRICULTURAL REQUIREMENTS FOR ATMOSPHERIC OZONE MEASUREMENTS
Denzil R. Davis and Charles E. Dean *In its* Observation and Meas. of Atmospheric Pollution 1974 p 49-57 refs (For

availability see N75-11476 02-45)

Ozone damage to plants, an ozone monitoring program and advisory service, established to serve the needs of agricultural interests of N-Florida and S-Georgia, are reviewed. The instrumentation and methods used in the program are described, and the meteorological parameters responsible for atmosphere ozone concentration are discussed. The program generated sufficient data to enable a forecast development service to be instituted which warns growers of observed and imminent ozone levels.
ESRO

N75-11483 World Meteorological Organization, Geneva (Switzerland).
AN AIR QUALITY DATA ANALYSIS SYSTEM FOR INTERRELATING EFFECTS, STANDARDS, AND NEEDED SOURCE REDUCTIONS
Ralph I. Larsen *In its* Observation and Meas. of Atmospheric Pollution 1974 p 58-70 refs (For availability see N75-11476 02-45)

Variables involved in designing an air quality data analysis system are discussed. These include concentration slicing, averaging time, effects analysis, and ambient standards specifications. The characteristics of an aerometric monitoring and data analysis system are related.
ESRO

N75-11484 World Meteorological Organization, Geneva (Switzerland).
ON THE DEPOSITION OF CHEMICAL SUBSTANCES BY PRECIPITATION (AS OBSERVED WITH THE AID OF THE ATMOSPHERIC CHEMISTRY NETWORK IN SCANDINAVIA)
Lennart Granat *In its* Observation and Meas. of Atmospheric Pollution 1974 p 71-78 refs (For availability see N75-11476 02-45)

The atmospheric chemistry network in Scandinavia is briefly described, and error estimates for the observations are calculated. The problems arising when computing the areal deposition of substances is discussed.
ESRO

N75-11485 World Meteorological Organization, Geneva (Switzerland).
IMPROVED EVALUATION OF POLYCYCLIC HYDROCARBONS IN ATMOSPHERIC DUST BY GAS CHROMATOGRAPHY WITH GLASS BEADS COLUMNS
A. Liberti and L. Zoccolillo *In its* Observation and Meas. of Atmospheric Pollution 1974 p 79-88 refs (For availability see N75-11476 02-45)

An improved procedure for the analysis of polynuclear aromatic hydrocarbons in atmospheric particulate matter is described. The analysis is carried out by gas chromatography using a glass bead column pretreated with dodecylbenzene sulfonate and coated with Apiezon L. Results obtained by coupling this column with a mass spectrometer to obtain information on the polynuclear hydrocarbon content of dust are reported. ESRO

N75-11486 World Meteorological Organization, Geneva (Switzerland).
EVALUATION OF THE ACIDIMETRIC HYDROGEN PEROXIDE METHOD FOR MEASURING SULPHUR DIOXIDE IN AIR **c47**
M. Gentilizza, M. Fugas, and F. Valic *In its* Observation and Meas. of Atmospheric Pollution 1974 p 89-96 refs (For availability see N75-11476 02-45)

The results obtained by the acidimetric hydrogen peroxide method of sulfur dioxide concentrations in air were evaluated as to their correlation with true concentrations. The methods of sampling and analysis are described, and the results discussed.
ESRO

N75-11487 World Meteorological Organization, Geneva (Switzerland).
THE AUTOMATED AIR QUALITY MONITORING NETWORK IN THE NETHERLANDS
N. D. VanEgmond *In its* Observation and Meas. of Atmospheric Pollution 1974 p 97-110 (For availability see N75-11476 02-45)

The background and objectives of the automated networks in the Netherlands for monitoring air pollution and quality are described. Requirements and cost estimates for various data acquisition systems are discussed and a description is given of the national network and centers.
ESRO

N75-11488 World Meteorological Organization, Geneva (Switzerland).
ENERGY DISPERSIVE X-RAY FLUORESCENCE SPECTROMETRY FOR ANALYSIS OF AIR PARTICULATES AND MERCURY VAPOR
A. H. Pradzynski and J. R. Rhodes *In its* Observation and Meas. of Atmospheric Pollution 1974 p 111-124 refs Sponsored partly by State of Tex. Air Control Board and Columbia Sci. Ind. Corporate Management (For availability see N75-11476 02-45) (Contracts AT(40-1)-4205; DI-BM-H0-110985)

The use of energy dispersive X ray fluorescence spectrometry for analysis of air pollution particulates is discussed. The basic principles of the technique are outlined and the instrumentation described. The analysis of thin specimens is considered and the advantages of using the X ray method are noted. To exploit these advantages careful sample and standard preparation are required and this aspect is covered. As an example of the technique the analysis of mercury vapor in the atmosphere is described with emphasis on the collection and determination of mercury.
ESRO

N75-11489 World Meteorological Organization, Geneva (Switzerland).
BASIC PRINCIPLES OF DETERMINING ATMOSPHERIC POLLUTION IN THE USSR
M. E. Berljand, A. S. Zaitsev, N. S. Volberg, and V. I. Anufriev *In its* Observation and Meas. of Atmospheric Pollution 1974 p 125-133 refs (For availability see N75-11476 02-45)

The air pollution research conducted in the U.S.S.R. is described and some of the problems of observation noted. Progress in air pollution measuring methods is reviewed and the improvement of methods of chemical analysis and the installation of automatic gas analyzers and monitoring systems are discussed.
ESRO

N75-11490 World Meteorological Organization, Geneva (Switzerland).
SAMPLING AND MEASUREMENT OF AIR POLLUTANTS FROM THERMAL POWER PLANTS
K. Vikram Rastogi and K. S. Shah *In its* Observation and Meas. of Atmospheric Pollution 1974 p 134-142 refs (For availability see N75-11476 02-45)

The pollution potential of thermal power plants is considered and the types of pollutants described. Guidelines for sampling and making quantitative determinations of atmospheric pollutants are established with emphasis on limitations, storage effects, and computation of results. The types of equipment used for collecting are briefly reviewed and selected methods of sampling and measuring related to sulfur dioxide, nitrogen oxides, and carbon monoxide are given.
ESRO

N75-11491 World Meteorological Organization, Geneva (Switzerland).
SUGGESTIONS FOR MONITORING AIR POLLUTION IN DEVELOPING COUNTRIES
B. T. Commins and J. McK. Ellison *In its* Observation and Meas. of Atmospheric Pollution 1974 p 143-152 refs (For availability see N75-11476 02-45)

The main reasons for monitoring air pollution in developing countries are analyzed. The effects of air pollution and its sources are considered in detail and the situations where monitoring is required are identified. Requirements for sampling are discussed and the physical state of the pollutant to be sampled is described.
ESRO

N75-11492 World Meteorological Organization, Geneva (Switzerland).
CONSIDERATIONS FOR THE DESIGN AND OPERATION OF MONITORING NETWORKS IN METROPOLITAN AREAS
Paul R. Harrison *In its* Observation and Meas. of Atmospheric Pollution 1974 p 153-161 refs (For availability see N75-11476 02-45)

Considerations for the location of air quality instruments for

the purpose of long-term historical statistics and protection of the population health are discussed. The selection of instruments suitable for air pollution monitoring is reviewed and routine operations are described. ESRO

N75-11493 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF GASEOUS AND PARTICULATE POLLUTANTS ON URBAN AND REGIONAL SCALES
A. P. Altshuller *In its* Observation and Meas. of Atmospheric Pollution 1974 p 162-175 refs (For availability see N75-11476 02-45)

The requirements of the Air Quality Act of 1970 and the primary air quality standards are briefly outlined. Six air quality standards were promulgated for total suspended particulates, sulfur dioxide, carbon monoxide, photochemically generated oxidant/ozone and hydrocarbons, and nitrogen dioxide. The criteria on which the decision to select these six pollutants was based are noted, and the methods of sampling and measuring are described. Site selection for monitoring networks is discussed together with regional measurement and monitoring. Special considerations in health and welfare studies are briefly mentioned. ESRO

N75-11494 World Meteorological Organization, Geneva (Switzerland).
FINDINGS FROM THE SULPHUR DIOXIDE SURVEY AT THE REFINERY CENTRE INGOLSTADT-NEUSTADT
K. H. Kellner *In its* Observation and Meas. of Atmospheric Pollution 1974 p 176-187 (For availability see N75-11476 02-45)

A survey of sulfur dioxide emissions from industrial plants in southern Germany is described. The observing system, recording and sampling of emissions, as well as background meteorological data are discussed. Intermediate results of the observations relating to long-term development, seasonal variations, and interdependance on wind direction and inversions are presented. ESRO

N75-11495 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTION CONDITIONS IN FAIRBANKS, ALASKA
S. G. Bigler, K. MacKenzie, and R. A. Willis *In its* Observation and Meas. of Atmospheric Pollution 1974 p 188-195 refs (For availability see N75-11476 02-45)

Following a description of general meteorological conditions at Fairbanks, Alaska, the formation of thermal inversions and ice fog are discussed and the effect these have on air pollution is examined. The carbon monoxide situation is reviewed and methods of sampling it and particulates during winter are described. The impact of the high concentration of pollutants on the development plans for the area are also briefly noted. ESRO

N75-11496 World Meteorological Organization, Geneva (Switzerland).
EVALUATION OF A HI-VOL SAMPLING NETWORK FOR FORECASTING POLLUTION POTENTIAL IN A SUBURBAN AREA
Steven R. Albersheim and John E. Lewis *In its* Observation and Meas. of Atmospheric Pollution 1974 p 196-205 refs (For availability see N75-11476 02-45)

The representativeness of the hi-vol sampling network in Prince Georges County with respect to the air quality standards established by the US Environmental Protection Agency is evaluated. The methodology of monitoring suspended particulate matter and the hi-vol sampling network are described. Results are presented together with meteorological conditions. ESRO

N75-11497 World Meteorological Organization, Geneva (Switzerland).
THE METHOD FOR MEASUREMENT AND OBSERVATION OF NITROGEN OXIDES
Yukikazu Takabayashi *In its* Observation and Meas. of Atmospheric Pollution 1974 p 206-215 refs (For availability see N75-11476 02-45)

The present state of air pollution in Osaka, Japan, is outlined with emphasis on sulfur oxides, carbon monoxide, nitrogen oxides, and other pollutants. The properties of nitrogen oxides and their effect on man and the environment are reviewed, and methods for their measurement, observation and control are discussed. ESRO

N75-11498 World Meteorological Organization, Geneva (Switzerland).
A TECHNIQUE FOR MEASUREMENT OF SULPHUR DIOXIDE AND SULPHATE CONCENTRATIONS FROM AN AIRCRAFT
D. A. Johnson and D. H. F. Atkins *In its* Observation and Meas. of Atmospheric Pollution 1974 p 216-222 refs (For availability see N75-11476 02-45)

An airborne air sampling is described which, using a dry filtration technique, enables sulfur dioxide and sulfate concentration to be determined over distances of 40 km or more. ESRO

N75-11499 World Meteorological Organization, Geneva (Switzerland).
APPROACHES AND RESULTS OF AN EFFECT MONITORING-PROGRAMME IN THE STATE NORDRHEIN-WESTPHALIA
B. Prinz *In its* Observation and Meas. of Atmospheric Pollution 1974 p 223-235 refs (For availability see N75-11476 02-45)

The pollution monitoring program established in 1972 in Northrhine-Westphalia is discussed in relation to the effects on environment caused by pollutants. The results from the exposure of lichens, wood, and metal patterns are considered, and the uptake of pollutants by exposed grasse was studied. It is concluded that such a monitoring program produces more direct information than any other surveillance systems. ESRO

N75-11500 World Meteorological Organization, Geneva (Switzerland).
TECHNIQUES AND EXPERIENCES OF MEASUREMENT AND OBSERVATION OF MAJOR ATMOSPHERIC POLLUTANTS IN IRAN
A. Badakhshan *In its* Observation and Meas. of Atmospheric Pollution 1974 p 236-248 refs (For availability see N75-11476 02-45)

Intermittent, continuous, and random sampling of major pollutants in Iran were carried out under different circumstances. The modes of sampling and measurement techniques are described, and interesting deductions and points of importance are discussed. ESRO

N75-11501 World Meteorological Organization, Geneva (Switzerland).
THE IMPORTANCE OF THE UTILIZATION OF ADEQUATE TECHNICAL METHODS IN THE ESTIMATION OF SUSPENDED PARTICULATES AS A PARAMETER OF AIR QUALITY [LA IMPORTANCIA DEL USO DE TECNOLOGIA ADECUADA EN LA ESTIMACION DE PARTICULAS SUSPENDIDAS COMO PARAMETRO DE CALIDAD DE AIRE]
H. Bravo, A. C. Lowe, and S. Salazar *In its* Observation and Meas. of Atmospheric Pollution 1974 p 249-258 refs In SPANISH (For availability see N75-11476 02-45)

Methods and techniques for measuring particles suspended in the atmosphere in order to determine air quality are briefly described. The results of studies carried out in Mexico are discussed, particularly the studies which used the reflectance method. ESRO

N75-11502 World Meteorological Organization, Geneva (Switzerland).
METHODS FOR THE AUTOMATIC RECORDING OF ATMOSPHERIC DUST CONCENTRATIONS AND SOME OF THE RESULTS OBTAINED
N. N. Aleksandrov, S. A. Konkov, and G. S. Gunija *In its* Observation and Meas. of Atmospheric Pollution 1974 p 257-264 refs (For availability see N75-11476 02-45)

The photometric and radiometric processes of determining the quantities of atmospheric dust deposited on filters are summarized, and the characteristics of various types of filters are noted. A photometric method utilizing a sampling device which draws air through a tape filter is described, and results are given of gravimetric and photometric analyses of the dust. ESRO

N75-11503 World Meteorological Organization, Geneva (Switzerland).
BASELINE OBSERVATIONS OF ATMOSPHERIC TRACE GASES IN THE ARCTIC ATMOSPHERE OF NORTH AMERICA
J. J. Kelley *In its* Observation and Meas. of Atmospheric Pollution 1974 p 265-275 refs (For availability see N75-11476 02-45)

The need for monitoring the trace gases in the atmosphere was stressed in an experimental program instituted at Barrow, Alaska for carbon dioxide and ozone concentration measurements. Results of observations are presented and discussed with emphasis on seasonal variations. ESRO

N75-11504 World Meteorological Organization, Geneva (Switzerland).
AIRCRAFT MEASUREMENTS OF THE CONCENTRATION AND SIZE DISTRIBUTION OF ATMOSPHERIC SULFATE PARTICLES
E. Meszaros *In its* Observation and Meas. of Atmospheric Pollution 1974 p 276-281 refs (For availability see N75-11476 02-45)

A simple set of aircraft collectors designed to capture aerosol particles in three size ranges for subsequent chemical analysis is described. The preliminary results concerning the size distribution of sulfate particles at different levels of the lower troposphere are also presented. ESRO

N75-11505 World Meteorological Organization, Geneva (Switzerland).
CORRELATION SPECTROSCOPY TECHNIQUES FOR THE REGIONAL AND GLOBAL MEASUREMENTS OF AIR POLLUTION **c35**
J. H. Davies *In its* Observation and Meas. of Atmospheric Pollution 1974 p 282-296 refs (For availability see N75-11476 02-45)

The remote sensing approach to air quality monitoring is reviewed, and optical correlation techniques applied to remote sensing of gaseous atmospheric constituents are discussed. Correlation spectroscopy is described, and results of studies using the method for aircraft and balloon measurements of sulfur and nitrogen dioxide are presented. The application of airborne and satellite mounted remote sensors to atmospheric monitoring is also discussed. ESRO

N75-11506 World Meteorological Organization, Geneva (Switzerland).
A CRITICAL APPRAISAL OF THE PERFORMANCE OF THE AIR SAMPLING EQUIPMENT USED IN THE EUROPEAN AIR SAMPLING NETWORK **c35**
J. L. Brownscombe, M. R. Porter, and P. Goldsmith *In its* Observation and Meas. of Atmospheric Pollution 1974 p 297-306 refs (For availability see N75-11476 02-45)

A series of studies is described on the collection and retention efficiency of an air sampling bubbler. These include laboratory assessments using artificial sodium chloride aerosols, and the operation of two bubblers in a series to determine their efficiency in the field. Comparisons with other methods are discussed. ESRO

N75-11507 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC ELECTRICAL CONDUCTIVITY AND THE DETECTION OF GLOBAL AEROSOL POLLUTION
William E. Cobb *In its* Observation and Meas. of Atmospheric Pollution 1974 p 307-315 refs (For availability see N75-11476 02-45)

The notion of the electrical conductivity of the atmosphere as a useful tool in aerosol research, particularly with respect to global air pollution, is considered. The process of atmospheric conductivity is described and its correlation to suspended particulates expressed. Conductivity measurements and observational procedures are described. ESRO

N75-11508 World Meteorological Organization, Geneva (Switzerland).
AN ATMOSPHERE HYDROGEN FLUORIDE MONITOR **c35**
Joke Kaaijk *In its* Observation and Meas. of Atmospheric Pollution 1974 p 316-323 refs (For availability see N75-11476 02-45)

The principle of operation of a hydrogen fluoride monitor in which gaseous fluorides are separated from particulate matter in a miniature cyclone is described. Calibration and testing of the apparatus is discussed and results and applications reviewed. ESRO

N75-11509 World Meteorological Organization, Geneva (Switzerland).
MONITORING OF CO, SO2 AND HC IN AIR BY GAS CHROMATOGRAPHY **c35**
Fabrizio Bruner and Paolo Ciccioli *In its* Observation and Meas. of Atmospheric Pollution 1974 p 324-333 refs (For availability see N75-11476 02-45)

The use of gas chromatography for the determination of air pollutants is discussed. Improvements to equipment; calibrating and separating are described for monitoring of carbon monoxide, sulfur dioxide and hydrocarbons. ESRO

N75-11510 World Meteorological Organization, Geneva (Switzerland).
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE. THE NOAA PROGRAM
D. H. Pack, R. Fegley, G. Herbert, D. Hoyt, W. Komhyr, J. Miller, and C. Turner *In its* Observation and Meas. of Atmospheric Pollution 1974 p 334-345 refs (For availability see N75-11476 02-45)

The overall objective of the NOAA's program is to predict the effects of natural or artificial emissions into the atmosphere on climate. The processes by which the monitoring program was designed, locations for additional observations selected, the rationale for the primary measurement program and a brief discussion of the intrumentation, the quality control and data aspects required for the program are outlined. ESRO

N75-11511 World Meteorological Organization, Geneva (Switzerland).
A SYSTEM FOR BACKGROUND AND REGIONAL MONITORING
H. D. Axelrod, A. F. Wartburg, R. J. Teck, M. D. Lahue, M. Campbell, and J. P. Lodge, Jr. *In its* Observation and Meas. of Atmospheric Pollution 1974 p 346-353 (For availability see N75-11476 02-45)

A system for monitoring and collecting data on the background levels of trace constituents in the atmosphere is described. The Principles on which development was based are given together with costs and results obtained. ESRO

N75-11512 World Meteorological Organization, Geneva (Switzerland).
FIELD MEASUREMENT OF RATES OF OXIDATION OF SO2
B. Manowitz and L. Newman *In its* Observation and Meas. of Atmospheric Pollution 1974 p 354-362 refs (For availability see N75-11476 02-45)

Measurements are discussed of the rates of oxidation of sulfur dioxide in coal and oil fired plumes for distances up to 20 kilometers by three simultaneous techniques. These are: direct measurement of SO2 and sulfate concentrations; measurement of the ratio of SO2 to SF6 (injected in the stack gases) and measurement of the isotopic ratio of S-32 to S-34 in plume SO2. The flue gas and plume sampling techniques are described. ESRO

N75-11513 World Meteorological Organization, Geneva (Switzerland).
AIR POLLUTANT SAMPLING BY K2CO3 FILTERS IN METEOROLOGICAL SHELTERS [ECHANTILLONNAGE DE POLLUANTS ATMOSPHERIQUES PAR FILTRE AU K2CO3 EXPOSES DANS ABRIS METEOROLOGIQUES]
F. Nucciotti and G. Simonini *In its* Observation and Meas. of Atmospheric Pollution 1974 p 363-369 refs In FRENCH (For availability see N75-11476 02-45)

An economical automated system for the determination of mean temporal values of a large number of air pollutants is described. The system uses dehydrated filters of potassium carbonate and their preparation before and treatment after sampling is outlined. The application of the method by several meteorological networks in the Po Valley (Italy) is discussed. ESRO

N75-11514 World Meteorological Organization, Geneva (Switzerland).
THE COLLECTION AND ANALYSIS OF TRACE ELEMENTS IN ATMOSPHERIC PARTICULATE MATTER OVER THE NORTH ATLANTIC OCEAN c47
R. A. Duce, G. L. Hoffman, J. L. Fasching, and J. L. Moyers *In its* Observation and Meas. of Atmospheric Pollution 1974 p 370-379 refs (For availability see N75-11476 02-45)
(Grants NSF GX-28340; NSF GX-33777)

The objectives of the atmospheric chemistry program at the University of Rhode Island are briefly outlined. The data collection program, which has its primary sampling site on Bermuda, is described and the analysis by neutron activation and atomic adsorption of trace elements from the atmospheric samples collected is discussed. An air sampling program carried out in Antarctica at the end of 1970 is summarized and chemical analysis techniques are described. The results, which enabled the determination of 22 trace elements, are presented and discussed. ESRO

N75-11515 World Meteorological Organization, Geneva (Switzerland).
TRACE METALS IN THE ANTARCTIC ATMOSPHERE c47
W. H. Zoller, E. S. Gladney, R. A. Duce, and G. L. Hoffman *In its* Observation and Meas. of Atmospheric Pollution 1974 p 380-386 refs (For availability see N75-11476 02-45)

The suitability of the Antarctic continent for measuring chemical composition, sizes and qualities of current background aerosols is discussed. An air sampling program carried out in Antarctica at the end of 1970 is summarized and chemical analysis techniques are described. The results, which enabled the determination of 22 trace elements, are presented and discussed. ESRO

N75-11516 World Meteorological Organization, Geneva (Switzerland).
METHOD OF MEASUREMENT OF VERY LOW CONCENTRATIONS OF SUBMICRON AEROSOLS c35
S. Ohta and T. Ito *In its* Observation and Meas. of Atmospheric Pollution 1974 p 387-393 refs (For availability see N75-11476 02-45)

The Pollak and Aitken nucleus counters for the measurement of submicron aerosol concentration are described. The accuracy of both instruments is noted and recent results of the measurement of the background values of submicron aerosols are given. ESRO

N75-11517 World Meteorological Organization, Geneva (Switzerland).
SURFACE OZONE MONITORING c47
Samuel J. Oltmans *In its* Observation and Meas. of Atmospheric Pollution 1974 p 394-403 refs (For availability see N75-11476 02-45)

Three reasons for including surface ozone measurements in a program of geophysical monitoring are discussed. The instrumentation to be used in the program - the electrochemical concentration cell meter - is described together with calibration techniques, quality control, and the kinds of data available. ESRO

N75-11518 World Meteorological Organization, Geneva (Switzerland).
COMPARATIVE STUDIES ON SEVERAL METHODS FOR THE DETERMINATION OF NITROGEN OXIDES IN AIR
A. Bertolaccini and S. Cerquiglini Monteriolo *In its* Observation and Meas. of Atmospheric Pollution 1974 p 404-412 refs (For availability see N75-11476 02-45)

In order to monitor and determine nitrogen oxides in air a comparison was conducted of three different techniques: colorimetry, chemiluminescence, and electrochemical. Results are presented, and these are in acceptable agreement. ESRO

N75-11519 World Meteorological Organization, Geneva (Switzerland).
OBSERVATIONS OF TOTAL OZONE WITH DOBSON SPECTROPHOTOMETERS
R. D. Grass *In its* Observation and Meas. of Atmospheric Pollution 1974 p 413-422 refs (For availability see N75-11476 02-45)

The mean amount of atmospheric ozone was monitored on a continuing basis from a network of Dobson ozone spectrophotometer stations equipped with instruments that were intercalibrated with one another. The reliability of measurements is discussed, together with a history of the monitoring program and field station procedures. The total ozone trend over North America is analyzed, and the stability of instrument calibrations considered. ESRO

N75-11520 World Meteorological Organization, Geneva (Switzerland).
RADIATION MEASUREMENTS AS INDICATORS OF NATURAL AND MAN-MADE ATMOSPHERIC AEROSOL c47
M. H. Unsworth *In its* Observation and Meas. of Atmospheric Pollution 1974 p 423-433 refs Partly sponsored by Ciba-Geigy and the Roy. Meteorol. Soc. (For availability see N75-11476 02-45)

Some of the effects of aerosol on solar radiation (both direct and diffuse) are discussed and methods of monitoring turbidity and of distinguishing between different types of aerosol by using well established instrumentation are proposed. ESRO

N75-11521* World Meteorological Organization, Geneva (Switzerland).
GLOBAL MEASUREMENTS OF AIR POLLUTION FROM SATELLITES
L. L. Acton, E. R. Bartle, M. Griggs, G. D. Hall, W. D. Hesketh, C. B. Ludwig, W. Malkmus, and H. Reichle *In its* Observation and Meas. of Atmospheric Pollution 1974 p 434-442 refs (For availability see N75-11476 02-45)
(Contract NAS1-12048)

The conceptual design of an FOV nadir radiometer was examined for its applicability to monitoring the radiation process in the atmosphere as it relates to aerosol behavior. The instrument employs a gas filter correlation technique and is suitable for transportation onboard satellite. ESRO

N75-11522 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF ATMOSPHERIC PARTICLES FROM SATELLITES c47
Robert S. Fraser *In its* Observation and Meas. of Atmospheric Pollution 1974 p 443-454 refs (For availability see N75-11476 02-45)

Satellite measurements of the characteristics of atmospheric particles that exist exterior to clouds are discussed, using a model for the earth atmosphere system which describes scattered sunlight in order to examine the general considerations of the effects of particles of light scattered to a satellite. Measured radiances from ERTS-1 data are given and compared with data from ground-based observations. It is concluded that satellite instruments are capable of measuring radiances with sufficient relative, but not absolute, accuracy to derive particle characteristics. ESRO

N75-11523 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF TRACE STRATOSPHERIC GASES BY INVERTING THERMAL INFRARED LIMB RADIANCE PROFILES c47
John C. Gille, James M. Russell, III, Paul L. Bailey, and Frederick B. House *In its* Observation and Meas. of Atmospheric Pollution 1974 p 455-462 refs (For availability see N75-11476 02-45)

An infrared technique for the remote measurement by satellite of minor constituents in the upper troposphere, stratosphere, and lower mesosphere is described. The spectral features used are explained, and the quality of results expected are discussed. A summary of expected capabilities from such an experiment is presented, with consideration of instrumentation requirements. ESRO

N75-11524 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC TURBIDITY MEASUREMENTS WITH THE DUAL-WAVELENGTH SUNPHOTOMETER c47
E. C. Flowers, R. A. McCormick, K. R. Kurfis, and T. H. Bilton *In its* Observation and Meas. of Atmospheric Pollution 1974 p 463-480 refs (For availability see N75-11476 02-45)

The accuracy and precision of the sunphotometer, and the accuracy limitations imposed by the data reduction procedures are discussed for the dual-wavelength instrument used for atmospheric turbidity observations. ESRO

N75-11525 World Meteorological Organization, Geneva (Switzerland).
ESTIMATION OF SULFUR DIOXIDE AND SOILING INDEX FROM OBSERVED SOLAR RADIANT FLUX DENSITY ATTENUATION Ph.D. Thesis - Yale Univ. - c47
William A. Sprigg *In its* Observation and Meas. of Atmospheric Pollution 1974 p 481-489 refs (For availability see N75-11476 02-45)
(Grants NSF GA-25784; RSA-71-9)

An experiment is described which was designed to test the hypothesis that measurements of direct solar beam attenuation may provide a method of estimating mean city wide sulfur dioxide concentration and soiling index values. The study was designed primarily to determine the characteristics of solar radiant flux density within the urban atmosphere, and measurements of solar intensity depletion were taken. The results are discussed, and it is concluded that the method is useful for SO2 monitoring. ESRO

N75-11526 World Meteorological Organization, Geneva (Switzerland).
THE INTEGRATING NEPHELOMETER AS AN INSTRUMENT FOR MEASURING THE SCATTERING COEFFIEIENT OF THE ATMOSPHERE AND ITS USE IN ATMOSPHERIC POLLUTION STUDIES c35
J. A. Garland *In its* Observation and Meas. of Atmospheric Pollution 1974 p 490-505 refs (For availability see N75-11476 02-45)

The application of the nephelometer in investigating the effect of aerosol composition and concentration on visibility is reviewed, and its potential for yielding information on particle size is discussed. Difficulties arising from the incomplete integration of scattered light are also explained. ESRO

N75-11527 World Meteorological Organization, Geneva (Switzerland).
GROUND-BASED MEASUREMENTS OF SOLAR RADIATION BY GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE (USA) c35
Douglas V. Hoyt and Gary A. Herbert *In its* Observation and Meas. of Atmospheric Pollution 1974 p 506-515 refs (For availability see N75-11476 02-45)

A progress report is presented on the geophysical monitoring for climatic change (GMCC) program which is to provide baseline observations of the incident solar radiation. The field and calibration instrumentation (multichannel pyroheliometers, pyranometers, and radiometers) are described in detail, and aspects of the data analysis are discussed. ESRO

N75-11528 World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF LONG-TERM TRENDS OF PARTICULATE AIR POLLUTION FROM VISIBILITY DATA
A. Manes, M. Rindsberger, D. Guetta, and A. Teitelman *In its* Observation and Meas. of Atmospheric Pollution 1974 p 516-525 refs (For availability see N75-11476 02-45)

A study to determine whether the trend of particulate air pollution can be deduced through the analysis of long term visibility records is discussed in terms of the theory behind the process and the data reduction procedures employed. The techniques used in the long term trend analysis are also discussed and it is concluded that such long term records of visibility data can be reduced to a statistically meaningful size, suitable for the determination of the long term trend of particulate air pollution. ESRO

N75-11529* World Meteorological Organization, Geneva (Switzerland).
MICROWAVE ROTATIONAL SPECTROSCOPY: A PHYSICAL TECHNIQUE FOR SPECIFIC POLLUTANT MONITORING c35
Lawrence W. Hrubesh *In its* Observation and Meas. of Atmospheric Pollution 1974 p 526-537 refs (For availability see N75-11476 02-45)
(NASA Order L-75902; Contracts EPA-IAG-D179(D))

Evidence is presented that microwave rotational spectroscopy can be developed for use in air pollution monitoring, with the employment of a diode-cavity spectrometer capable of detecting small concentrations of NO2, SO2, H2CO, and HN3 gas with very high specificity. The theory behind the technique is discussed, together with its application and experimental results. ESRO

N75-11530 World Meteorological Organization, Geneva (Switzerland).
INFLUENCE OF THE SUN'S AUREOLE ON THE DETERMINATION OF TURBIDITY c47
C. Froehlich and H. Quenzel *In its* Observation and Meas. of Atmospheric Pollution 1974 p 538-544 refs Sponsored in part by Deut. Forschungsgemeinschaft (For availability see N75-11476 02-45)

Results of computations for different aerosol models are presented demonstrating the influence of the sun's aureole on the determination of turbidity with a Volz-type sunphotometer. The fundamentals of turbidity determination are discussed and computation of the aureole intensity given. Errors in turbidity determination are also considered. ESRO

N75-11531 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENTS OF METEOROLOGICAL PARAMETERS AND AIR POLLUTION SPREAD OVER STOCKHOLM, SWEDEN, BY MEANS OF REMOTE SENSING AND AIRBORNE INSTRUMENTATION
Lars E. Olsson, Christer Persson, Arne Haagaard, Hans Ottersten, Lennart Granat, and Claes Traegaardh *In its* Observation and Meas. of Atmospheric Pollution 1974 p 545-556 refs Sponsored partly by the Swed. Environ. Protect. Board and the Swed. Board for Tech. Develop. (For availability see N75-11476 02-45)

A comparison is made of different available measurement techniques suitable for studies of mesoscale air pollution dispersion over Stockholm, Sweden. The measurement program is outlined and the aircraft instrumentation briefly described. The results are presented and discussed. ESRO

N75-11532 World Meteorological Organization, Geneva (Switzerland).
OBSERVATIONS OF ATMOSPHERIC TEMPERATURE INVERSION LAYERS USING A 100 PPS GP YAG LASER RADAR CAR c47
K. Goto, T. Tsuji, Y. Higuchi, and H. Kimura *In its* Observation and Meas. of Atmospheric Pollution 1974 p 557-566 refs (For availability see N75-11476 02-45)

The radar application of a YAG laser for atmospheric temperature inversion observation is discussed. The principles of operation of a 100 pps YAG laser radar are outlined and a description is given of the compact laser radar car. Results show that such a system is useful for the observation of inversion layers, without any restriction in operating time and space. ESRO

N75-11533 World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF THE LOCAL REMOVAL OF SULPHUR DIOXIDE BY PRECIPITATION c47
T. D. Davies *In its* Observation and Meas. of Atmospheric Pollution 1974 p 567-578 refs (For availability see N75-11476 02-45)

Sulfur dioxide washout, on a small time-scale, is related to ground level atmosphere SO2 concentrations and to various meteorological and climatological parameters. The sampling and analytical method and its immediate consequences are discussed. Intermediate results concerning SO2 washout at town and country stations, the role of washout, its intensity, the type of precipitation and atmospheric SO2 concentration are presented. ESRO

N75-11534 World Meteorological Organization, Geneva (Switzerland).
THE MEASUREMENT OF DEPOSITION VELOCITIES FOR SULPHUR DIOXIDE AND PARTICULATE MATERIAL BY THE GRADIENT METHOD
D. H. F. Atkins and J. A. Garland *In its* Observation and Meas.

of Atmospheric Pollution 1974 p 579-594 refs (For availability see N75-11476 02-45)

Removal of atmospheric sulfur dioxide by dry deposition and its measurement by the gradient method are discussed. The method together with the sampling technique are described. Analysis results and accuracy are noted. The extension of the method to obtain profiles for other atmospheric constituents is also summarized. ESRO

N75-11535 World Meteorological Organization, Geneva (Switzerland).

STANDARD REFERENCE MATERIALS FOR AIR POLLUTION

James R. McNesby *In its* Observation and Meas. of Atmospheric Pollution 1974 p 595-603 (For availability see N75-11476 02-45)

The NBS program for the provision of standard reference materials for measuring ambient air and source emissions to methods of absolute measurement is discussed. New advanced standard concepts are also explained. ESRO

N75-11536 World Meteorological Organization, Geneva (Switzerland).

COLLABORATIVE TESTING AND EVALUATION OF METHODS USED TO ASCERTAIN AIR QUALITY

Benjamin Levadie *In its* Observation and Meas. of Atmospheric Pollution 1974 p 604-615 refs (For availability see N75-11476 02-45)

A program for the evaluation of methods used in measuring air quality is described. The methods tested and to be tested are listed and the statistical information produced as a result of the tests is summarized. ESRO

N75-11537 World Meteorological Organization, Geneva (Switzerland).

ACCURATE GAS STANDARDS FOR AIR POLLUTION ANALYSES

E. E. Hughes and J. K. Taylor *In its* Observation and Meas. of Atmospheric Pollution 1974 p 616-628 (For availability see N75-11476 02-45)

The need for standards for analysis of gaseous air pollutants is stressed. The accuracy, stability and availability of standard reference gases is discussed and a description is given of several specific systems for propane, carbon monoxide, sulfur dioxide, nitrogen dioxide, and nitric oxide in nitrogen. ESRO

N75-11538 World Meteorological Organization, Geneva (Switzerland).

QUALITY CONTROL IN THE MEASUREMENT OF AIR POLLUTANTS

John H. Harley *In its* Observation and Meas. of Atmospheric Pollution 1974 p 629-635 (For availability see N75-11476 02-45)

A laboratory quality control program for the measurement of air pollutants is discussed from the viewpoint of a user of data who hopes to draw scientific conclusions. The analyses and field quality control measurements are also described. ESRO

N75-11539 World Meteorological Organization, Geneva (Switzerland).

DEVELOPING A DATA HANDLING SYSTEM FOR STORAGE AND RETRIEVAL OF DATA RESULTING FROM WHO AND WMO GLOBAL MONITORING NETWORKS

Gerald G. Akland, Thomas C. Lawless, Stephen K. Goranson, and S. David Shearer *In its* Observation and Meas. of Atmospheric Pollution 1974 p 636-646 refs (For availability see N75-11476 02-45)

The background to the WMO and WHO air monitoring programs is outlined and the data handling system - with emphasis on the interlocking relationships from sampling through analysis and data evaluation - is described. The implementation of the system, including storage and retrieval of data for the two collaborating networks, is also reviewed. ESRO

N75-11540 World Meteorological Organization, Geneva (Switzerland).

QUALITY CONTROL IN GLOBAL AND REGIONAL AIR CHEMISTRY MONITORING NETWORKS: LESSONS OF THE EUROPEAN AIR CHEMISTRY NETWORK c47

M. P. Paterson and R. S. Scorer *In its* Observation and Meas. of Atmospheric Pollution 1974 p 647-655 refs (For availability see N75-11476 02-45)

A preliminary analysis was made of annual data on the Ca/Mg ratio from the continental area of the European Air Chemistry Network. The results of this analysis are given and it is concluded that much of the data is wrong, due to faults in the chemical analysis. ESRO

N75-11541# Environmental Health Lab., Kelly AFB, Tex.

BIODEGRADABILITY AND TOXICITY STUDIES OF PHOTOGRAPHIC PROCESSING WASTES AT OFFUTT AFB, NEBRASKA

Jerry F. Thomas and Edward E. LeFebvre Jul. 1974 39 p refs

(AD-784786; EHL(K)-74-16) Avail: NTIS CSCL 13/2

Biodegradation and toxicity studies were completed for photographic processing wastewaters generated by the 544th Aerospace Reconnaissance Technical Wing (SAC) Photo Plant at Offutt AFB, Nebraska. Composite samples were prepared from each of the sets and evaluated for biodegradability and toxicity. The toxicity studies were performed by using Pimephales promelas (Fathead Minnows) as test animals and the effluent from a bench-scale activated sludge plant treating the composite photowaste samples. The toxicity of the photowaste composite prepared from the March set of samples was approximately 20 times that of the composite prepared from the September set of samples after treatment, using Pimephales promelas. (Modified author abstract) GRA

N75-11542# Missouri Univ., Rolla. Div. of Engineering Research.

OIL SPILL DRIFT CAUSED BY THE COUPLED EFFECT OF WIND AND WAVES Final Report

Ronald L. Reisbig Oct. 1973 69 p refs

(Contract DOT-CG-24603-A)

(AD-777702; USCG-D-52-74) Avail: NTIS CSCL 08/3

A study of the potential effect of wind and waves on oil spill drift was completed. The investigation was initiated to evaluate the importance of coupled wind and wave drift mechanisms for computer simulations of the total drift. The experiment was designed to allow the waves to be generated independently from the wind. Drift velocity results for oil lenses and other floats are reported for wind currents and water waves traveling in the same direction, in the opposite direction, and at fixed angles to each other. Experimental results are also reported for the effects, of wave length, air turbulence, and float design. (Modified author abstract) GRA

N75-11543# Battelle-Northwest, Richland, Wash.

GEOGRAPHICAL ANALYSIS OF OIL SPILL POTENTIAL ASSOCIATED WITH ALASKAN OIL PRODUCTION AND TRANSPORTATION SYSTEMS Final Report

W. H. Swift, R. E. Brown, L. V. Kimmel, M. M. Orgill, and P. L. Petersen Feb. 1974 273 p refs

(Contract DOT-CG-23223-A)

(AD-784099; USCG-D-79-74) Avail: NTIS CSCL 13/2

The future development of petroleum production and transportation in Alaska is reviewed, and the magnitude of associated oil pollution problems is estimated. The environmental conditions which affect spill cleanup are also summarized. The total recoverable oil reserves in Alaska and its continental shelves and slopes are estimated to exceed 200 billion barrels, of which 70% may be derived from offshore sources. It is predicted that as the trans-Alaskan pipeline increases production oil pollution potential will increase until almost every mile of Alaskan coastline is subject to potential oil spills. (Modified author abstract) GRA

N75-11544# Argonne National Lab., Ill.

A GENERALIZED AIR QUALITY ASSESSMENT MODEL FOR AIR FORCE OPERATIONS: AN OPERATOR'S GUIDE Final Report, 1 May 1973 - 1 Jan. 1974

Lawrence E. Wagen and Donald M. Rote Jun. 1974 83 p refs

(AF Proj. 1900)

(AD-784809; AFWL-TR-74-54) Avail: NTIS CSCL 13/2

The Energy and Environmental Division of Argonne National Laboratory has developed a set of computer programs under contract to the United States Air Force Weapons Laboratory. The package is designed to serve as a generalized model that can be used to assess the impact of Air Force operations on the air environment at the air base level. The report is a user's manual for these computer programs and as such outlines the overall flow of the programs, the links between programs and the input data required to implement each program. This document is intended to provide detailed instructions as to input flow and not to supply technical or scientific basis. A companion document subtitled, Phase 1 Technical Report discussed the modeling theory and methods. Author (GRA)

N75-11545# Air Force Weapons Lab., Kirtland AFB, N.Mex.
ECOLOGICAL STUDY REQUIREMENTS FOR VANDENBERG AIR FORCE BASE, CALIFORNIA Final Report, 8 Jan. - 2 Apr. 1974
Rutherford C. Wooten, Jr., George F. Meyer, John W. Sigler, and Claude L. Scott Jul. 1974 61 p refs
(AF Proj. 683L)
(AD-784800; AFWL-TR-74-129) Avail: NTIS CSCL 06/6

A study was conducted at Vandenberg AFB, CA to determine the requirements for a detailed ecological study, to determine the impact of the Space Transportation System on the ecology of Vandenberg, and to determine the need and direction of future land management. Vandenberg has a variety of vegetative communities which support various species of animal and bird life. The coastal areas may support a rich abundance of marine life. Recommendations include a systematic approach and multidiscipline study to determine the significance and associativity of the various forms of biota. (Modified author abstract) GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N75-11546# Weapons Research Establishment, Adelaide (Australia).
A DETERMINATION OF THE DAYTIME THERMOSPHERIC WIND PROFILE BY OBSERVING A LITHIUM TRAIL WITH A FIELD-OF-VIEW SCANNER
A. D. Hind and K. H. Lloyd Nov. 1973 17 p refs
(WRE-TN-989(WR/D)) Avail: NTIS HC $3.25

The design of an instrument which was built for the detection of the lithium 671 nm line against the daytime sky continuum is described. The instrument, which covers the field-of-view by use of a servo-controlled scanning mirror, detects the lithium line by chopping the received beam and using phase sensitive detection. Data obtained on a daytime release of lithium between 90 and 130km altitude are presented, and the methods for the analysis of these data to obtain a wind profile of the upper atmosphere are described. The derived wind profile is similar to those observed at twilight and night. Author

N75-11547*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE USE OF GEOMAGNETIC FIELD MODELS IN MAGNETIC SURVEYS
Robert D. Regan (USGS) and Joseph C. Gain Sep. 1974 21 p refs Submitted for publication
(NASA-TM-X-70777; X-922-74-295) Avail: NTIS HC $3.25 CSCL 08N

The importance of global geomagnetic field models for the reduction of magnetic surveys is discussed. It is demonstrated that a numerical model with adequate secular variation correction, provides a suitable representation of the regional field. The limitations of the presently available models are reported, with emphasis on the International Geomagnetic Reference Field. Author

N75-11548*# California Univ., Los Angeles. Plasma Physics Group.
STIMULATED BRILLOUIN BACKSCATTER IN THE EQUATORIAL ELECTROJET
D. D. Barbosa and C. F. Kennel Nov. 1974 25 p refs
(Grant NGL-05-007-190)
(NASA-CR-140820; Publ-1386; PPG-200) Avail: NTIS H $3.25 CSCL 04A

The temporal growth rate of stimulated Farley-Buneman type modes and the instability threshold were computed for a 50 MHz CW radar incident upon the equatorial electrojet. An estimate of the total convective amplification across the electrojet determines radar power levels at which significant enhancement of backscatter was also observed. Author

N75-11549*# California Univ., Los Angeles.
PROCEEDINGS OF THE UCLA INTERNATIONAL CONFERENCE ON RADIATION AND REMOTE PROBING OF THE ATMOSPHERE
Jacob G. Kuriyan, ed. 1974 422 p refs Conf. held at Los Angeles, 28-30 Aug. 1973 Sponsored by DOT, NASA, TRW Systems, and Army
(NASA-CR-140816) Avail: NTIS HC $10.50 CSCL 04A

Various articles are presented on multiple scattering problems and radiative transfer in the atmosphere. Particle size distribution and molecular absorption are also discussed. For individual titles, see N75-11550 through N75-11562.

N75-11550* Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
SOLVING MULTIPLE SCATTERING PROBLEMS IN PLANETARY ATMOSPHERES
William M. Irvine and J. Lenoble (Lille Univ. des Sci. et Tech.) *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 1-57 refs (For availability see N75-11549 02-46)
(Grants NGL-22-010-023; NSF GP-22742)
(Contrib-171) CSCL 04A

Multiple scattering problems, radiative transfer problems in planetary atmospheres within extended visible portion of the spectrum, are examined. The direct and inverse problems and the extinction coefficient are defined, along with other scattering characteristics. Albedos in semi-infinite and finite atmospheres are considered, as well as surface illumination, energy deposition, and polarization. The Eddington approximation figures prominently in the calculations. Precise numerical methods and analytical solutions are included. J.A.M.

N75-11551* Akademiya Nauk SSSR, Novosibirsk.
SOLUTION OF THE RADIATIVE TRANSFER THEORY PROBLEMS BY THE MONTE CARLO METHOD
G. I. Marchuk and G. A. Mikhailov *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 58-73 refs (For availability see N75-11549 02-46)
CSCL 04A

The Monte Carlo method is used for two types of problems. First, there are interpretation problems of optical observations from meteorological satellites in the short wave part of the spectrum. The sphericity of the atmosphere, the propagation function, and light polarization are considered. Second, problems dealt with the theory of spreading narrow light beams. Direct simulation of light scattering and the mathematical form of medium radiation model representation are discussed, and general integral transfer equations are calculated. The dependent tests method, derivative estimates, and solution to the inverse problem are also considered. J.A.M.

N75-11552* Tohoku Univ., Sendai (Japan).
RADIATIVE TRANSFER OF VISIBLE RADIATION IN TURBID ATMOSPHERE
Giichi Yamamoto and Masayuki Tanaka *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 74-134 refs (For availability see N75-11549 02-46)
CSCL 04A

Methods are presented for solving radiative transfer problems; they include the doubling method and the closely related matrix method, iterative method, Chandrasekhar's method of discrete ordinates, and Monte Carlo method. To consider radiation

transport through turbid atmosphere, an atmospheric model was developed characterizing aerosols by parameters. Intensity and polarization of radiation in turbid atmospheres is discussed, as well as lower atmospheric heating due to solar radiation absorption by aerosols. J.A.M.

N75-11553* Mainz Univ. (West Germany).
SCATTERING AND ABSORPTION FROM POLY-DISPERSED AEROSOLS
K. Bullrich, R. Eiden, G. Eschelbach, K. Fischer, G. Haenel, and J. Heintzenberg *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 135-161 refs (For availability see N75-11549 02-46)
CSCL 04A

Results from numerical computations of the diffuse sky radiances and degree of polarization are given. These results were obtained by solving the equation of radiative transfer in the formulation of Eschelbach. In these computations, multiple scattering and absorption by aerosol particles were considered. In addition, results from experimental measurements of the complex refractive index of aerosol samples at different relative humidities are presented. From the radiation flux divergences which were computed based on the determined properties of atmospheric aerosol particles, atmospheric heating rates were derived which were found to be comparable to the heating rates by water vapor. Author

N75-11554* Leiden Univ. Observatory (Netherlands).
MULTIPLE SCATTERING IN CLOUD LAYERS; SOME RESULTS
H. C. VanDeHulst *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 162-195 refs (For availability see N75-11549 02-46)
CSCL 04A

Theoretical methods are discussed for calculating radiative effects of aerosols. Experimental determination is emphasized for relevant aerosol parameters on a global basis to arrive at realistic estimates of heating and cooling. Internal radiation fields in very thin and very thick slabs are reviewed. Phase functions, polarization, emission by internal sources, and path length distribution are also considered. J.A.M.

N75-11555* Ljubljana Univ. (Yugoslavia). Dept. of Physics.
SOME ANALYTICAL RESULTS FOR RADIATIVE TRANSFER IN THICK ATMOSPHERES
I. Kuscer and N. J. McCormick *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 196-226 refs Sponsored in part by NSF (For availability see N75-11549 02-46)
CSCL 04A

Singular eigenmode expansions are a convenient analytical tool with which to study problems of monochromatic radiative transfer in thick or semi-infinite atmospheres. Some closed-form solutions are presented for anisotropic scattering, with the neglect of polarization effects. A basic ingredient for applications to the semi-infinite medium is Chandrasekhar's H-function, which is best defined through the Wiener-Hopf factorization. The solutions of the Milne and albedo problems are discussed in order that the method of matched asymptotic approximations may be used to describe the solution for a thick atmosphere adjacent to a diffusely reflecting ground. Expressions for the emerging distributions are quoted. A possible extension of the general scheme to problems involving polarization is indicated. Author

N75-11556* California Univ., Los Angeles. Dept. of Physics.
LECTURES ON THE SCATTERING OF LIGHT
David S. Saxon *In its* Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 227-308 refs (For availability see N75-11549 02-46)
CSCL 04A

The exact (Mie) theory for the scattering of a plane wave by a dielectric sphere is presented. Since this infinite series solution is computationally impractical for large spheres, another formulation is given in terms of an integral equation valid for a bounded, but otherwise general array of scatterers. This equation is applied to the scattering by a single sphere, and several methods are suggested for approximating the scattering cross section in closed form. A tensor scattering matrix is introduced, in terms of which some general scattering theorems are derived. The application of the formalism to multiple scattering is briefly considered. Author

N75-11557* Leningrad (A. A. Zhdanov) State Univ. (USSR).
INFLUENCE OF THE ATMOSPHERE ON SPECTRAL RADIANCE AND CONTRASTS OF NATURAL FORMATIONS MEASURED FROM SPACE
K. Ya. Kondratyev, A. A. Buznikov, O. B. Vasilyev, and O. I. Smokty *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 309-336 refs (For availability see N75-11549 02-46)
CSCL 04A

The method of transfer functions is discussed that enable the elimination of atmospheric effects from spectral photometric data measured from spacecraft. Soyuz 7, 9 and Salyut spacecraft data were used. The results made it possible to estimate the variations in the transfer functions in the visible spectral region depending on the albedo of the underlying surface both for the uniform surfaces and near the boundary between two uniform underlying surfaces. J.A.M.

N75-11558* California Univ., Los Angeles. Dept. of Meteorology.
PARTICULATE SIZES FROM POLARIZATION MEASUREMENTS
Jacob G. Kuriyan *In its* Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 337-366 refs Sponsored in part by DOT and NASA (For availability see N75-11549 02-46)
CSCL 04A

Radiation measurements from a ground based polarimeter were used to infer the optical properties of atmospheric particles. The inherent nonunigueness in model calculations is discussed. The inverse problem in atmospheric optics is described, along with incident and emergent beams. Emergent radiation was calculated for all possible particulate distributions, and results were catalogued. J.A.M.

N75-11559* Stanford Research Inst., Menlo Park, Calif. Atmospheric Sciences Lab.
LIDAR OBSERVATIONS OF ATMOSPHERIC PARTICULATE CONTENT
R. T. H. Collis, P. B. Russell, E. E. Uthe, and W. Viezee *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 367-394 refs (For availability see N75-11549 02-46)
CSCL 04A

The role of lidar in atmospheric studies concerned with radiative energy transfer and remote sensing is summarized. The application of lidar to climatic change investigations is proposed. J.A.M.

N75-11560* National Center for Atmospheric Research, Boulder, Colo.
METHODS OF CALCULATING INFRARED TRANSFER: A REVIEW
John C. Gille *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 395-430 refs Sponsored by NSF (For availability see N75-11549 02-46)
CSCL 04A

Methods for calculating the transfer of infrared radiation in planetary atmospheres are summarized. Direct spectral integration is compared with high precision measurements, suggesting that calculational techniques are sufficient for molecular atmospheres. Infrared transfer is used to study the atmospheric energy budget and atmospheric structures. J.A.M.

N75-11561* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MOLECULAR ABSORPTION PARAMETERS IN ATMOSPHERIC MODELLING
Robert A. McClatchey *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 431-470 refs (For availability see N75-11549 02-46)
CSCL 04A

Molecular spectroscopic parameters are compiled for a number

of infrared-active molecules occurring naturally in the terrestrial atmosphere. The following molecules are included in this compilation: water vapor; carbon dioxide; ozone; nitrous oxide; carbon monoxide; methane; and oxygen. The spectral region covered extends from less than 1 micron to the far infrared, and data are presented on more than 100,000 spectral lines. The parameters included in the compilation for each line are: frequency, intensity, half-width, energy of the lower state of the transition, vibrational and rotational identifications of the upper and lower energy states, an isotopic identification, and a molecular identification. Using this data compilation, band model parameters are presented for water vapor, carbon dioxide, and ozone averaged over 20 wavenumber intervals. Using these parameters in a random model formulation, transmittance spectra are provided and compared with both degraded monochromatic calculations and laboratory data. Author

N75-11562* Oxford Univ. (England). Clarendon Lab.
INFRARED REMOTE SOUNDING **c43**
C. D. Rodgers *In* Calif. Univ. Proc. of the UCLA Intern. Conf. on Radiation and Remote Probing of the Atmosphere 1974 p 471-506 refs (For availability see N75-11549 02-46)
CSCL 04A

Atmospheric radiation was measured as a function of wavelength, position, angle, and time. Radiation was determined by temperature, cloud (aerosol), composition, and surface emissivity measurements. The theory of radiative transfer is reviewed, along with retrieval methods. Instruments onboard space probes for infrared remote sounding of planetary atmospheres are also described. J.A.M.

N75-11563# Academia R. P. R., Bucharest.
EXPERIMENTAL METHOD FOR THE DETERMINATION OF THE GRAVITATIONAL INTERACTION VELOCITY IN NEWTONIAN GRAVITATIONAL FIELDS
G. Cristea 1974 13 p refs
(IFA-FR-117-1974) Avail: AEC Depository Libraries HC $4.00

An experiment is proposed for measuring the velocity of the gravitational interaction in Newtonian gravitational fields. The phase difference in time between the gravitation potential of the moon and the curve of a function of the position, in regard to a point on the earth, of the natural satellite is to be experimentally measured. The detection of the delayed moon potential is proposed to be made by means of a pendulum.
Author (NSA)

N75-11564# Texas Instruments, Inc., Dallas. Equipment Group.
FAR FIELD STUDIES: COMPARATIVE ANALYSIS OF UPPER MANTLE Q AND OTHER GEOPHYSICAL DATA ON THE EURASIAN CONTINENT Semiannual Technical Report, 1 May - 31 Oct. 1973
Stephen A. Alsup 15 Nov. 1973 52 p refs
(Contract F44620-73-C-0055; ARPA Order 1827)
(AD-779747; TI-ALEX(02)-TR-73-01-Pt-A; AFOSR-74-0781TR)
Avail: NTIS CSCL 08/11

A review and comparative analysis of published reports providing research data within Eurasia concerning the upper mantle geophysics shows the following: high upper mantle P-wave velocities, early relative teleseismic P-wave delays, low heat flow, absence of low-resistivity upper mantle layers, and regions of Eurasia. Opposite relative values of the parameters given above correspond to the active structural and volcanic regions, most notably the sea of Okholsk, sea of Japan, Kamchatka, Kuril Japan region, around lake Baykal, and along the southern to southwestern border of the U.S.S.R. Maps and brief discussions of the parameters mentioned, including a regional estimate of upper mantle q for p waves, are given. Author (GRA)

N75-11565# Woods Hole Oceanographic Institution, Mass.
PRELIMINARY CRUISE REPORT AND INDEX OF GEOPHYSICAL DATA, CHAIN 115 LEG 1
D. A. Richards, S. R. Gegg, and R. C. Groman Jun. 1974 20 p
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-783105; WHOI-74-38) Avail: NTIS CSCL 08/10

Geological and geophysical activities which were undertaken during Leg 1 (Woods Hole to Dakar) of R/V CHAIN Cruise 115 (SOUTHLANT Expedition) are summarized. A series of charts and profiles display the navigation, bathymetry, total-field magnetic anomaly, and free-air gravity anomaly measurements, as well as the locations of seismic reflection lines and coring, heat flow, and hydrographic stations. (Modified author abstract) GRA

N75-11566# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ELECTRON IMPACT EXCITATION OF N2, O2 AND O AND UPPER ATMOSPHERIC DIAGNOSTICS WITH ELECTRON BEAM FLUORESCENCE PROBES
Anthony A. Haasz Oct. 1973 198 p refs
(Grant AF-AFOSR-2091-71; AF Proj. 9783)
(AD-784897; UTIAS-194; AFOSR-74-1431TR) Avail: NTIS CSCL 07/4

Characteristic emission spectra in the 2000A to 6000A wavelength range, induced by 0.6-3 keV energy electrons, were obtained for molecular nitrogen, molecular oxygen and atomic oxygen. To study the atomic oxygen fluorescence, ground state O atoms were produced in the absence of O2 molecules by the N + NO to N2 + O titration reaction. Absolute excitation cross sections were obtained for some of the prominent spectral features of N2, O2 and O; the emissions were selected on the basis of their applicability for upper atmospheric diagnostics with electron beam fluorescence probes. In parallel with the laboratory investigations of the electron beam induced fluorescence in atmospheric gases, an electron beam fluorescence probe (EBFP) has been developed for rocket flight applications in the 80 to 150 km altitude range. The EBFP is capable of measuring vibrational and rotational temperatures as well as species concentrations in the upper atmosphere. The instrument employs a 2.5 keV, 4 mA electron beam to induce fluorescence in the ambient gas of the atmosphere. (Modified author abstract)
GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N75-11567 Colorado State Univ., Fort Collins.
EMPIRICAL ASSESSMENT OF ACCRETION MICROPHYSICS Ph.D. Thesis
Roger Frederick Reinking 1974 365 p
Avail: Univ. Microfilms Order No. 74-20733

Empirical means were used to provide an improved description of the process of droplet accretion on snow crystals. Snow crystal specimens were collected and replicated on microscope slides during 1971-73 winter storms in the Central Sierra Nevada of California. Measurements were made of rime droplet size and the amount of riming on the snow crystals, and of corresponding crystal concentrations and diffusional crystal type, size, and growth. A critical, expanded analysis of the simple theory of accretion by aerodynamic droplet capture aided in the explications. All stages of continuous accretion are empirically described. The observations demonstrate that crystal growth habits, as well as sizes, strongly regulate the crystal mass gained by riming. Crystals below a certain size do not collect rime. This practical minimum size varies systematically with habit. Dissert. Abstr.

N75-11568# Joint Publications Research Service, Arlington, Va.
ACCURATE WEATHER FORECASTING
30 Oct. 1974 28 p ref Transl. into ENGLISH from Priroda (Moscow), no. 7, 1974 p 3-18
(JPRS-63318) Avail: NTIS HC $3.75

Weather anomalies and their effects on weather forecasting are considered. For individual titles, see N75-11569 through N75-11570.

N75-11569 Joint Publications Research Service, Arlington, Va.
PROGRESS AND DIFFICULTIES IN WEATHER FORECASTING
Kh. P. Pogosyan *In its* Accurate Weather Forecasting (JPRS-63318) 30 Oct. 1974 p 1-15 ref Transl. into ENGLISH

from Priroda (Moscow), no. 7, 1974 p 3-11 (For availability see N75-11568 02-47)

Statistical and synoptical methods to analyze atmospheric processes for purposes of long range weather forecasting are eleborated. Methods are also developed for modifying atmospheric processes to regulate and prevent droughts, snow and ice storms, squalls and torrential rains by studying energy exchanges between the atmosphere and the underlying surface. G.G.

N75-11570 Joint Publications Research Service, Arlington, Va.
WHY DO WEATHER ANOMALIES OCCUR?
A. A. Girs *In its* Accurate Weather Forecasting (JPRS-63318) 30 Oct. 1974 p 16-26 Transl. into ENGLISH from Priroda (Moscow), no. 7, 1974 p 12-18 (For availability see N75-11568 02-47)

Cosmic-geophysical factors in the formation and variation of atmospheric circulation and weather conditions in the various regions of the earth have to be considered in long range weather forecasting. In addition to terrestrial factors, solar activity, variation in speed of rotation of the earth, nutation of the poles, tidal phenomena in the oceans, etc., clearly affect long term trends in the variation of the atmospheric and hydrospheric characteristics of the earth. G.G.

N75-11571# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, SEPTEMBER 1974 Key to Meteorological Records Documentation no. 5.4
Sep. 1974 95 p refs
Avail: NTIS HC $4.75

Daily mosaics are presented for the Northern and Southern Hemispheres. These were prepared from data swaths by a scanning radiometer on the NOAA 2 satellite. Author

N75-11572# Illinois State Water Survey, Urbana.
METROMEX STUDIES Summary Report, 1971 - 1972
F. A. Huff, ed. 1973 173 p refs Sponsored by AEC
(COO-1199-34) Avail: NTIS HC $6.25

Metromex, a large-scale investigation of inadvertent weather modification in an urban area is described. Analyses to date from two-years of data collected in the five-year Metromex field program are summarized. Extensive climatological-statistical analyses are included of rainfall and severe weather events with partial analyses for various atmospheric studies. The two-year results provide evidence that rain, thunderstorms, and hail maximize at locations 10 to 15 miles downwind of the urban-industrial region. These locations had more storms that were more intense, lasted longer, and produced greater amounts of rain and hail. Results also show that the atmosphere modified by heat and various emissions in the urban area does move up to levels where it can affect clouds. The urban-modified atmosphere acts to invigorate convective storms and to increase the efficiency of precipitation events. Author (NSA)

N75-11573# Sandia Labs., Albuquerque, N.Mex.
MINICOMPUTER-CONTROLLED LIGHTNING EARLY WARNING/METEOROLOGICAL SYSTEM
W. W. Shurtleff Apr. 1974 19 p refs Sponsored by AEC
(SLA-74-134) Avail: NTIS HC $3.25

The lightning early warning/meteorological system is a generalized data acquisition and output system with the added feature that all communication takes place over long distances (up to 30 miles) to provide for its purpose to collect potential gradient information from a matrix of sensors around the Albuquerque, New Mexico area, and retransmit this information to various installations and test sites. Any readings which indicate an impending high potential gradient immediately prompt the observance of standard explosive safety procedures. A secondary purpose is to collect meteorological information from remote sites for display, analysis, and recording at the main station. Functional block diagrams of the system illustrate channels for input and output, and technical details are given for the minicomputer which controls the system. Author

N75-11574# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
PLANETARY TRANSPORT PROCESSES IN THE UPPER ATMOSPHERE Annual Progress Report
R. E. Newell 20 Mar. 1974 18 p refs
(Contract AT(11-1)-2195)
(COO-2195-13) Avail: NTIS HC $3.25

A program of research is described which was directed towards the extension of diagnostic studies of the upper atmosphere to higher levels, by applying the results of previous diagnostic studies to global trace substance problem, particularly carbon monoxide and ozone, and by applying data about the global energy budget to the problem of glacial-interglacial changes. Recent data were also examined for evidence of volcanic effects, in order that the influence of volcanic aerosol on both stratospheric and tropospheric circulation might be more fully understood. Author

N75-11575# Atmospherics, Inc., Fresno, Calif.
METROMEX 1973: A SUMMARY OF OPERATIONS CONDUCTED BY ATMOSPHERICS, INCORPORATED DURING THE PERIOD 7 JULY - 19 AUGUST 1973 Final Report
T. J. Henderson and D. W. Duckering 30 Dec. 1973 53 p refs Prepared for Ill. State Water Surv.
(Contract AT(11-1)-1199)
(COO-1199-31) Avail: NTIS HC $3.75

Project Metromex, which is a large-scale investigation of inadvertent weather modification in an urban area, sited at St. Louis, is reported. Operations reported include rainwater sampling, aircraft-released chemical tracer studies of clouds air mass movements, and air sampling and analysis. Both aircraft and radiosonde of data temperature, moisture, and particulate concentration measurements are presented. NSA

N75-11576# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE VARIABILITY OF VISIBILITY IN THE HANSCOM MESONETWORK: A PRELIMINARY ASSESSMENT Environmental Research Papers
Donald A. Chisholm and Horst Kruse 13 Jun. 1974 32 p refs
(AF Proj. 8628)
(AD-784791; AFCRL-ERP-479; AFCRL-TR-74-0265) Avail: NTIS CSCL 04/2

A preliminary assessment of the temporal and spatial variability of visibility in the Hanscom mesonetwork has been conducted with approximately eight months (September 1972 - April 1973) of data. The variability of measurements obtained from forward scatter visibility meters (FSM) was found to be greatest in radiation fog episodes and least in precipitation in both time and space. Time variability was found not to be greatly affected by local topography and to be less at 45 m than at 4 m above ground level. An examination of interpolation error, through the method of optimum interpolation, revealed an improvement in the error of about 20 percent when the distance between observation points is halved in advective situations and about 10 percent in radiation fog episodes. Relating the interpolation errors to the natural variability of visibility prescribed the prediction potential of the Hanscom mesonetwork for short range prediction experiments. Author (GRA)

N75-11577# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF HEAVY RAINFALL IN THE CARPATHIAN MOUNTAINS OF THE UKRAINE
I. D. Loeva 19 Jun. 1973 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 266, p 103-112
(AD-784359; FSTC-HT-23-1272-73) Avail: NTIS CSCL 04/2

Heavy rainfalls (with daily totals of 30 mm or more) appear to be a changeable characteristic of precipitation in the Carpathian Mountains. The principal cause of their variability is the result of orographic factors and large fluctuations in atmospheric conditions from year to year. During warm seasons heavy rainfalls occur yearly in the Carpathians. Where orographic factors are conducive to the formation of heavy rains, they are 2 to 3 times more frequent than in less hilly places with milder conditions. In the course of the warm seasons over 23 years in the regions of 19 meteorological stations, about 800 rainfalls were registered. GRA

N75-11578# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
MESOSCALE MODELING, FORECASTING AND REMOTE SENSING RESEARCH Final Report, Oct. 1968 - Oct. 1973
Carl W. Kreitzberg, Donald J. Perkey, and John E. Pinkerton May 1974 313 p refs
(Contract F19628-69-C-0092; AF Proj. 7922)
(AD-784875; AFCRL-TR-74-0253) Avail: NTIS CSCL 04/2

Results of a five-year project on light beam and laser (Raman scattering) remote sensing, cyclonic scale diagnostic studies and mesoscale numerical modeling and forecasting are summarized. Mechanisms involved in the release of potential instability are discussed and simulated quantitatively, giving particular attention to the convective formulation. The basic mesoscale model is documented including the equations, boundary condition, finite differences and initialization through an idealized frontal zone. Results of tests including a three dimensional test with real data, tests of convective/mesoscale interaction and tests with a detailed mesoscale boundary layer formulation are presented. GRA

N75-11579# Army Foreign Science and Technology Center, Charlottesville, Va.
MICROSTRUCTURE OF PRECIPITATION DEPOSITED ON HORIZONTAL SURFACES IN FOG
L. Z. Prokh 15 Apr. 1974 13 p refs Transl. into ENGLISH from Tr. Nauch.-Issled. Gidrometeorol. Inst. (Kiev), no. 42, 1964 p 36-41
(AD-784742; FSTC-HT-23-359-74) Avail: NTIS CSCL 04/2

The report presents some results of systematic measurements of droplet size and content of the liquid deposits formed in fog on horizontal surfaces in the steppe zone of the Ukraine. GRA

N75-11580# Naval Postgraduate School, Monterey, Calif.
OCEANIC EXTREME MODEL ATMOSPHERES FOR AERO-THERMODYNAMIC CALCULATIONS
Frank L. Martin 1 Sep. 1974 38 p refs
(AD-784735; NPS-51MR74091A) Avail: NTIS CSCL 04/2

In earlier papers (Model Atmospheres I and II), a procedure was developed for determining the most probable vertical temperature profile associated with the occurrence of 1% world-wide temperature extremes at mandatory-pressure levels, and at stations where such extremes are known to exist. The same technique based upon the use of the stepwise multiple regression analysis was employed in this study to determine vertically consistent atmospheres corresponding to known oceanic extremes. Cold open-ocean extremes were found to exist up to 300 mb primarily near the Labrador coast at OSV B, while the warm-open ocean extremes were found to exist in the vicinity of Majuro atoll of the Marshall Islands. The warmest of all sea-extremes for near-port conditions was found to exist in the Persian Gulf (near Station Bahrain). (Modified author abstract) GRA

N75-11581# Denver Univ., Colo. Dept. of Mathematics.
FOURIER ANALYSIS OF STRATIFIED AIRFLOW OVER MOUNTAINS Interim Report
C. H. C. Wang and D. L. Hector 1974 46 p refs
(Grant AF-AFOSR-2306-72; AF Proj. 9749)
(AD-784941; MS-R-7409; AFOSR-74-1368TR) Avail: NTIS CSCL 04/2

The Fourier analysis of the air flow over a mountain ridge in a channel bounded above and below by solid boundaries is performed in this report. The primary objective of this analysis is to provide initial data for the integration of ray equations in a ray theory for such linearized flows. The present analysis assumes a constant wind velocity profile and constant Brunt-Vaisala frequency distribution across the channel and the disturbances to the flow are treated in the small perturbation context. The linear equations which govern these small perturbations are Fourier analized and expressions for the perturbation flow velocity are then derived. Author (GRA)

N75-11582*# Systems Science and Software, La Jolla, Calif.
THE EFFECTS OF MESO-SCALE AND SMALL-SCALE INTERACTIONS ON GLOBAL CLIMATE Semiannual Technical Report, 1 Nov. 1973 - 15 Jul. 1974
T. N. Jerskey and W. J. Wiscombe 15 Jul. 1974 86 p refs
(Contract F44620-74-C-0035; ARPA Order 2609)
(AD-784857; SSS-R-74-2331; AFOSR-74-1338TR) Avail: NTIS CSCL 04/2

The objective in this contract period has been to parameterize the drag induced by the mountain lee waves by characterizing the atmospheric response function in terms of the atmospheric variables provided by the Rand Global Circulation Model. During the past six months of the contract period considerable progress was made toward parameterization of the lee wave drag for incorporation into the Mintz-Arakawa Global Circulation Model. The limitations imposed by the two-level model are described in this report, and an analytic model consistent with the data available from the two-level model has been formulated for the zonal component of the stress. The authors have outlined the work to be completed to formulate the meridional stress. The work on the radiation portion of the contract has primarily involved the improvement of existing codes. The radiation codes have been made compatible with the IBM 360/91 computer facility at UCLA. (Modified author abstract) GRA

N75-11435* Scientific Translation Service, Santa Barbara, Calif.
GEOGRAPHICAL CORRELATION OF EARTH CLOUD COVER PICTURES OBTAINED FROM UNORIENTED SATELLITES
V. I. Solovyev *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 165-173 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 141-146 (For availability see N75-11419 02-43)
CSCL 04B

N75-11486 World Meteorological Organization, Geneva (Switzerland).
EVALUATION OF THE ACIDIMETRIC HYDROGEN PEROXIDE METHOD FOR MEASURING SULPHUR DIOXIDE IN AIR
M. Gentilizza, M. Fugas, and F. Valic *In its* Observation and Meas. of Atmospheric Pollution 1974 p 89-96 refs (For availability see N75-11476 02-45)

N75-11514 World Meteorological Organization, Geneva (Switzerland).
THE COLLECTION AND ANALYSIS OF TRACE ELEMENTS IN ATMOSPHERIC PARTICULATE MATTER OVER THE NORTH ATLANTIC OCEAN
R. A. Duce, G. L. Hoffman, J. L. Fasching, and J. L. Moyers *In its* Observation and Meas. of Atmospheric Pollution 1974 p 370-379 refs (For availability see N75-11476 02-45)
(Grants NSF GX-28340; NSF GX-33777)

N75-11515 World Meteorological Organization, Geneva (Switzerland).
TRACE METALS IN THE ANTARCTIC ATMOSPHERE
W. H. Zoller, E. S. Gladney, R. A. Duce, and G. L. Hoffman *In its* Observation and Meas. of Atmospheric Pollution 1974 p 380-386 refs (For availability see N75-11476 02-45)

N75-11517 World Meteorological Organization, Geneva (Switzerland).
SURFACE OZONE MONITORING
Samuel J. Oltmans *In its* Observation and Meas. of Atmospheric Pollution 1974 p 394-403 refs (For availability see N75-11476 02-45)

N75-11520 World Meteorological Organization, Geneva (Switzerland).
RADIATION MEASUREMENTS AS INDICATORS OF NATURAL AND MAN-MADE ATMOSPHERIC AEROSOL
M. H. Unsworth *In its* Observation and Meas. of Atmospheric Pollution 1974 p 423-433 refs Partly sponsored by Ciba-Geigy and the Roy. Meteorol. Soc. (For availability see N75-11476 02-45)

N75-11522 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF ATMOSPHERIC PARTICLES FROM SATELLITES
Robert S. Fraser *In its* Observation and Meas. of Atmospheric Pollution 1974 p 443-454 refs (For availability see N75-11476 02-45)

N75-11523 World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF TRACE STRATOSPHERIC GASES BY INVERTING THERMAL INFRARED LIMB RADIANCE PROFILES
John C. Gille, James M. Russell, III, Paul L. Bailey, and Frederick B. House *In its* Observation and Meas. of Atmospheric Pollution 1974 p 455-462 refs (For availability see N75-11476 02-45)

N75-11524 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC TURBIDITY MEASUREMENTS WITH THE DUAL-WAVELENGTH SUNPHOTOMETER
E. C. Flowers, R. A. McCormick, K. R. Kurfis, and T. H. Bilton *In its* Observation and Meas. of Atmospheric Pollution 1974 p 463-480 refs (For availability see N75-11476 02-45)

N75-11525 World Meteorological Organization, Geneva (Switzerland).
ESTIMATION OF SULFUR DIOXIDE AND SOILING INDEX FROM OBSERVED SOLAR RADIANT FLUX DENSITY ATTENUATION Ph.D. Thesis - Yale Univ.
William A. Sprigg *In its* Observation and Meas. of Atmospheric Pollution 1974 p 481-489 refs (For availability see N75-11476 02-45)
(Grants NSF GA-25784; RSA-71-9)

N75-11530 World Meteorological Organization, Geneva (Switzerland).
INFLUENCE OF THE SUN'S AUREOLE ON THE DETERMINATION OF TURBIDITY
C. Froehlich and H. Quenzel *In its* Observation and Meas. of Atmospheric Pollution 1974 p 538-544 refs Sponsored in part by Deut. Forschungsgemeinschaft (For availability see N75-11476 02-45)

N75-11532 World Meteorological Organization, Geneva (Switzerland).
OBSERVATIONS OF ATMOSPHERIC TEMPERATURE INVERSION LAYERS USING A 100 PPS GP YAG LASER RADAR CAR
K. Goto, T. Tsuji, Y. Higuchi, and H. Kimura *In its* Observation and Meas. of Atmospheric Pollution 1974 p 557-566 refs (For availability see N75-11476 02-45)

N75-11533 World Meteorological Organization, Geneva (Switzerland).
DETERMINATION OF THE LOCAL REMOVAL OF SULPHUR DIOXIDE BY PRECIPITATION
T. D. Davies *In its* Observation and Meas. of Atmospheric Pollution 1974 p 567-578 refs (For availability see N75-11476 02-45)

N75-11540 World Meteorological Organization, Geneva (Switzerland).
QUALITY CONTROL IN GLOBAL AND REGIONAL AIR CHEMISTRY MONITORING NETWORKS: LESSONS OF THE EUROPEAN AIR CHEMISTRY NETWORK
M. P. Paterson and R. S. Scorer *In its* Observation and Meas. of Atmospheric Pollution 1974 p 647-655 refs (For availability see N75-11476 02-45)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N75-11583# Joint Publications Research Service, Arlington, Va.
MARCH OF THE CHERNOMOR
A. Podrazhanskiy, M. Rostarchuk, and G. Stefanov 7 Nov. 1974 217 p refs Transl. into ENGLISH of the book "Marsh Chernomora" Moscow, Div. of Gidrometeoizdat, 1973 188 p (JPRS-63388) Avail: NTIS HC $7.25
A documentary narrative is presented which deals with the development, construction, and submergence of the U.S.S.R. Chernomor sealab. Author

N75-11584# Joint Publications Research Service, Arlington, Va.
FLUCTUATIONS OF THE TRAVEL TIME OF A PULSE IN THE DEEP OCEAN
L. M. Nefedov 30 Oct. 1974 7 p refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 10, no. 4, 1974 p 645-647 (JPRS-63311) Avail: NTIS HC $3.25
The results of experiments to investigate fluctuations of the travel time of short pulse signals with multipath propagation through the underwater sound channel over comparatively long distances are discussed. Author

N75-11585# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Section.
NUMERICAL SOLUTION OF THE PROBLEM OF PROPAGATION OF THE SEMIDIURNAL TIDAL WAVES (M2 AND S2) IN THE WORLD OCEAN
K. T. Bogdanov and V. A. Magarik Jul. 1974 10 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Dokl. (USSR), v. 172, no. 6, 1967 p 1315-1317
(AD-784591; DMAAC-TC-2025) Avail: NTIS CSCL 08/3
The study represents an experiment in the numerical solution of the global problem of propagation of tidal waves. The solution of this problem, in addition to completeness of the obtained picture of propagation of tidal waves in the world ocean, makes it possible to almost completely avoid the representation of initial data along the hidden (water) boundaries of the water body and thereby to increase the accuracy of the solution. GRA

N75-11607 Joint Publications Research Service, Arlington, Va.
UNDERWATER INVESTIGATIONS OF IKHTIANDR CLUB
N. A. Akhlamov, Yu. M. Barats, Yu. N. Kiklevich, and A. B. Khayes *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 94-97 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 86-90 (For availability see N75-11596 02-52)

N75-11609 Joint Publications Research Service, Arlington, Va.
ON A PLAN FOR INTERDISCIPLINARY BLACK SEA UNDERWATER OBSERVATORY OF MOSCOW STATE UNIVERSITY
N. V. Vasilchikov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 107-122 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 98-114 (For availability see N75-11596 02-52)

N75-11610 Joint Publications Research Service, Arlington, Va.
ON EXPERIMENT IN BIOLOGICAL OPERATIONS FROM UNDERWATER LABORATORY CHERNOMOR IN 1968 (PRELIMINARY REPORT)
N. Ye. Denisov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 123-125 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 114-117 (For availability see N75-11596 02-52)

N75-11611 Joint Publications Research Service, Arlington, Va.
SCIENTIFIC PROGRAM CHERNOMOR-68
N. A. Aybulatov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 126-130 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 117-122 (For availability see N75-11596 02-52)

N75-11612 Joint Publications Research Service, Arlington, Va.
CERTAIN QUESTIONS IN ORGANIZATION OF SCIENTIFIC RESEARCH TASKS USING CHERNOMOR UNDERWATER LABORATORY AS A BASE
N. A. Aybulatov and V. S. Yastrebov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 131-135 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 122-127 (For availability see N75-11596 02-52)

N75-11613 Joint Publications Research Service, Arlington, Va.
HYDRO-OPTICAL STUDIES IN CHERNOMOR-68 EXPERIMENT (PRELIMINARY REPORT)
V. P. Nikolayev and Yu. L. Mashtakov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 136-142 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 127-133 (For availability see N75-11596 02-52)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N75-11586 Nauka Press, Moscow (USSR).
PROBLEMS OF SPACE BIOLOGY. VOLUME 22: EXCHANGE OF MATTER UNDER EXTREMUM CONDITIONS OF SPACE FLIGHT AND ITS SIMULATION [PROBLEMY KOSMICHESKOY BIOLOGII. TOM 22: OBMEN VESHCHESTEV V EKSTREMALNYKH USLOVIYAKH KOSMICHESKOY POLETA I PRI YEGO IMITATSII]
I. S. Balakhovskiy, Yu. V. Natochin, and V. N. Chernigovskiy, ed. 1973 211 p refs In RUSSIAN
Copyright. Avail: Issuing Activity

A ten-year experimental study of exchange processes in cosmonauts engaged in space flight is described. The results are compared with those from simulation studies and data published by American researchers. Excretion of water and salt during and after flight are discussed in detail. Detailed consideration is given to methods of clinical biology which were worked out for space medicine: Microchemical blood analyses, mass hemoglobin determination, and waste. General problems of water transport to osmoregulatory organs and the regulation of water-salt exchange are also reviewed. For individual titles, see N75-11587 through N75-11589.

N75-11587 Nauka Press, Moscow (USSR).
METHODS IN SPACE BIOLOGY, PART 1 [METODY KOSMICHESKOY BIOKHIMII, CHAST 1]
In its Probl. of Space Biol., Vol. 22 1973 p 6-88 In RUSSIAN (For availability see N75-11586 02-51)
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Various methods of biological analysis applicable to space biology are considered: a rapid method of biochemical analysis, dried blood studies, microchemical blood analysis, determination of the volume of circulating blood and its rate of transfer, determination of carboxyhemoglobin content in blood, and determination of the amount of absorbed CO in blood. Large and small filter blood sample analyses are considered, involving obtaining trichloroacetic acid extract for determining water-soluble material; determination of blood sugar, lactic acidurea, creatinine, fat-soluble material, cholesterol lipid phosphorus, and iron; titration determination of non-esterified fatty acids; and determination of glucose by fermentation. Microanalytic equipment described includes colorimetric systems with vertical and horizontal liquid columns, a capillary microcolorimeter, semimicrocuvettes, a microfluorometer, and a microburette. Transl. by K.P.D.

N75-11588 Nauka Press, Moscow (USSR).
METABOLISM AND KIDNEY FUNCTION DURING SPACE FLIGHT, PART 2 [OBMEN VESHCHESTV I FUNKTSIYA POCHEK BO VREMYA POLETA V KOSMOSE, CHAST 2]
In its Probl. of Space Biol., Vol. 22 1973 p 89-194 refs In RUSSIAN (For availability see N75-11586 02-51)
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Matter exchange and kidney function during space flight are considered. Among the topics discussed are dehydration as a reason for weight loss, salt extraction, possible mechanisms of water-salt exchange, state of nitrogen exchange in flight and simulation studies, changes in general hemoglobin volume in the organism, use of anabolic steroids in equalizing possible disruption of exchange processes, non-esterified fatty acids in the blood, blood cholesterol, changes in the functions of the endocrine system, and skin tissue processes. Transl. by K.P.D.

N75-11589 Nauka Press, Moscow (USSR).
MECHANISM OF WATER ABSORPTION IN CERTAIN OSMOREGULATORY ORGANS, PART 3 [O MEKHANIZME VSASYVANIYA VODY V NEKOTORYKH OSMOREGULIRUYUSHCHIKH ORGANAKH, CHAST 3]
In its Probl. of Space Biol., Vol. 22 1973 p 195-209 refs In RUSSIAN (For availability see N75-11586 02-51)
Copyright.

The mechanism of water absorption in several osmoregulatory organs is considered. The theory of osmotic transfer of liquids through a semitransparent membrane is reviewed. Permeability studies were conducted on frog bladders in water, and the transfer mechanism of water through the bladder wall. Transl. by K.P.D.

N75-11590*# Naval Biomedical Research Lab., Oakland, Calif.
STUDIES ON PROPAGATION OF MICROBES IN THE AIRBORNE STATE Quarterly Report, 1974 - 1975
R. L. Dimmick, H. Wolochow, Patricia Straat, and M. A. Chatigny [1974] 16 p
(NASA Order W-13450)
(NASA-CR-131844; QR-3) Avail: NTIS HC $3.25 CSCL 06M

An investigation was conducted to demonstrate whether airborne microbes could propagate. The procedure consisted of: (1) looking for dilution of a labelled base in DNA; (2) looking for labelling of DNA by mixing aerosols of the label and the cells; (3) examining changes in cell size; (4) testing the possibility of spore germination; and (5) seeking evidence of an increase in cell number. Results indicate that growth and propagation can occur under special conditions, principally at temperatures of approximately 30 C (87 F) and water activity equivalents of 0.95 to 0.98. Author

N75-11591*# North Dakota State Univ., Fargo. Dept. of Polymers and Coatings.
SOLUBILIZATION AND SPORE RECOVERY FROM SILICONE POLYMERS Ph.D. Thesis
Yu-Chuan Hsiao Jun. 1974 145 p refs
(Grant NGR-35-001-012)
(NASA-CR-140769) Avail: NTIS HC $5.75 CSCL 06M

A non-sporicidal technique for solvent degradation of cured silicone polymers was developed which involves chemical degradation of cured silicone polymers by amine solvents at room temperature. Substantial improvements were obtained in the recovery of seeded spores from room temperature cured polymers as compared to the standard recovery procedures, which indicates that the curing process is not sufficiently exothermic to reduce spore viability. The dissolution reaction of cured silicone polymers whith amine solvents is proposed to occur by bimolecular nucleophilic displacement. The chemical structure of silicone polymers was determined by spectroscopic methods. The phenyl to methyl ratio, R/Si ratio, molecular weight, and hydroxyl content of the silicone resins were determined. Author

N75-11592*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
TECHNIQUES OF BIOLOGICAL CONTAMINATION AVOIDANCE BY ATMOSPHERIC PROBES
R. E. DeFrees Aug. 1974 76 p refs
(Contract NAS2-7328)
(NASA-CR-137562) Avail: NTIS HC $4.75 CSCL 06M

The likelihood of biologically contaminating a planet by an atmospheric probe has a low probability of occurring if the probe is kept biologically clean during terrestrial operations and if the structure remains in tact until the planets life zone is completely

penetrated. High standards of cleanliness, monitoring and estimating for remedial actions must be maintained in a probe program. It is not a foregone conclusion, however, that heat sterilization needs to be employed. The use of several techniques having a good potential for lower probe costs are available and appear adequate to render a probe sterile within acceptable bounds. The techniques considered to be satisfactory for minimizing microbial load include: (1) combined heat (at 95-105 C) and gamma radiation; (2) short term heating at 105 + or - 5 C to inactivate all vegetative microbes; (3) irradiation routinely by ultraviolet light; (4) wiping by a bactericidal agent with or without a penetrant; and (5) cleanliness alone. Author

N75-11593*# Scientific Translation Service, Santa Barbara, Calif.
ABSORPTION OF EXOGENIC COENZYMES BY MITOCHONDRIAL STRUCTURES UNDER NORMAL CONDITIONS AND UNDER GRAVITATIONAL OVERLOAD
V. N. Totskiy, Ts. Namsray, and V. A. Olshanetskaya Washington NASA 29 Nov. 1974 13 p refs Transl. into ENGLISH from Vop. Med. Khim. (USSR), v. 20, no. 5, Sep. - Oct. 1974 p 463-467
(Contract NASw-2483)
(NASA-TT-F-16011) Avail: NTIS HC $3.25 CSCL 06C

Rat liver mitochondria, preincubated for 5 minutes at 30 C, absorbed well nicotinamide (NMN, NAD) and flavine (FMN, FAD) coenzymes from the media of incubation. Isolated outer and inner membranes of the organelles bound significantly lower amounts of NAD than the whole mitochondria; the structural proteins of the organelles practically exhibited no interaction with the coenzyme. After gravitational loading applied to animals, the capacity of mitochondria to absorb exogenic coenzymes was distinctly increased. This phenomenon was due to an increased permeability of mitochondrial membranes. In this case, the organelles associated not only with NMN, NAD, FMN, and FAD, but also with NADP, which did not penetrate mitochondria under normal conditions. Author

N75-11594*# Scientific Translation Service, Santa Barbara, Calif.
STUDIES ON THE PURIFICATION AND CHARACTERIZATION OF DIPEPTIDYLAMINOPEPTIDASE, 4
A. Barth, H. Schulz, and K. Neubert Washington NASA Nov. 1974 30 p refs Transl. into ENGLISH from Acta Biol. Med. Ger. (East Germany), v. 32, 1974 p 157-174
(Contract NASw-2483)
(NASA-TT-F-16017) Avail: NTIS HC $3.75 CSCL 06C

In the microsomal of pig kidneys, aside from particle-bound aminopeptidase (EC 3.4.1.2), a dipeptidyl aminopeptidase is observed which, upon solubilization, fractionated ammonium sulfate precipitation and column chromatography, can be separated from the aminopeptidase, and isolated purely by disc electrophoresis. It is assumed that dipeptidyl aminopeptidase IV possesses two different specifities for substrates with the sequence L-AS-L Ala-R, and for substrates with the sequence L-AS-L-Pro-R. The enzymatic hydrolysis of the two substrate sequences differs by the position of the optima and the inhibition by DFP. Whereas cations have a relatively weak influence on the enzymatic activity of dipeptidyl aminopeptidase IV, the influence of anions proved to be significant. Author

N75-11595# Wisconsin Univ., Madison. Dept. of Zoology.
ENERGY BUDGETS OF ANIMALS: BEHAVIORAL AND ECOLOGICAL IMPLICATIONS
May 1974 37 p refs
(Contract AT(11-1)-2270)
(COO-2270-2) Avail: NTIS HC $3.75

Energy balance equations for microclimates and animals were used to predict activity times, food requirements, and potential predator-prey interactions. Preliminary analyses of a simple predator-prey system had raised many more questions than it has answered. The model has pointed to a lack of vital information in the literature on digestive efficiences, growth rates in the field, biomass requirements for reproduction, and biomass requirements for early growth to maturity. Physiological measurements on a variety of active endotherm predators are also absent. Author

N75-11599 Joint Publications Research Service, Arlington, Va.
NARCOTIC EFFECT OF INCREASED NITROGEN AND HELIUM PRESSURES (BASED ON RESULTS FROM EXPERIMENTAL RESEARCH CONDUCTED ON ANIMALS)
V. P. Ponomarev and A. I. Selivra *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 25-29 refs Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 24-27 (For availability see N75-11596 02-52)

N75-11877* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF LUNAR SURFACE MATERIAL ON RADIATION DAMAGE IN MICE (INVESTIGATION OF BIOLOGICAL ACTION OF LUNAR SURFACE MATERIAL RETURNED TO EARTH BY LUNA 16 AUTOMATIC STATION)
V. V. Antipov, B. I. Davydov, N. A. Gaydamakin, T. S. Lvova, V. G. Petrukhin, S. N. Komarova, and Ye. B. Skvortsova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 613-626 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 596-604 (For availability see N75-11814 02-91)
CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N75-11596# Joint Publications Research Service, Arlington, Va.
SOME RESULTS AND PROSPECTS FOR THE USE OF UNDERWATER HABITATS IN MARINE INVESTIGATIONS
V. G. Azhazha, ed. 23 Oct. 1974 154 p refs Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 1-148
(JPRS-63261) Avail: NTIS HC $6.25

Aspects of the uses of underwater habitats, including the medical and physiological factors which involve participating personnel, are described in terms of data resulting from prolonged stays by investigators in undersea laboratories. For individual titles, see N75-11597 through N75-11614.

N75-11597 Joint Publications Research Service, Arlington, Va.
CONDITION AND WORK CAPABILITY OF MAN UNDER INCREASED PRESSURES AND OPTIMAL COMPOSITIONS OF GAS MEDIUM
G. L. Zaltsman *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 1-14 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 3-14 (For availability see N75-11596 02-52)

The initial narcotic effect of increased pressure of nitrogen in air on the human organism is described, along with the incipient narcotic effect of increased helium pressures; both effects constitute the overall physiological effect of increased pressures in a gaseous medium. The various types of hyperbaric narcosis are reported based on data acquired from the investigation of higher nervous activity in human subjects. An optimal condition is described whereby the composition of the gaseous medium is suitable for prolonged exposure to increased environmental pressure, as in underwater habitats. A.A.D.

N75-11598 Joint Publications Research Service, Arlington, Va.
FEATURES IN PROCESSES OF SATURATION (DESATURATION) AND OVERSATURATION OF AN ORGANISM AND PRINCIPLE OF ESTIMATING THE DECOMPRESSION REGIMES DURING EXTENDED STAY UNDER PRESSURE
G. L. Zaltsman *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 15-24 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 15-23 (For availability see N75-11596 02-52)

Experimental data are presented along with generalizing concepts which characterize the processes occurring in an organism under conditions of increased pressures. The principles of estimating the regimes of safe decompression are discussed for both brief and prolonged stays under pressure. The classical method of calculating the regimes according to the Haldane tables were modified with allowances for the appropriate data. Author

N75-11599 Joint Publications Research Service, Arlington, Va.
NARCOTIC EFFECT OF INCREASED NITROGEN AND HELIUM PRESSURES (BASED ON RESULTS FROM EXPERIMENTAL RESEARCH CONDUCTED ON ANIMALS) **c51**

V. P. Ponomarev and A. I. Selivra *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 25-29 refs Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 24-27 (For availability see N75-11596 02-52)

Experimental data obtained from animals with electrodes chronically implanted in the brain are discussed in terms of the narcotic effect of nitrogen and helium (incipient manifestations) during increase in pressure to 400 gage atmospheres. The presence of variations in the brain's electrical activity in the absence of visible modifications of behavior in the initial period of the narcotic influence exerted by neutral gases is stressed. Author

N75-11600 Joint Publications Research Service, Arlington, Va.
PHYSIOLOGICAL DESCRIPTION OF DECOMPRESSION PHENOMENA

P. M. Gramenitskiy *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 30-36 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 27-34 (For availability see N75-11596 02-52)

The aeroembolic process is described which develops in an organism as a result of transformation of a dissolved neutral gas to a free state after a reduction in external pressure. The appearance of emboli triggers a definite reaction of the cardiovascular and respiratory systems; such a reaction is considered protective. The inadequacy of this reaction evokes the appearance of the symptoms of decompression sickness. Author

N75-11601 Joint Publications Research Service, Arlington, Va.
TOLERABLE OXYGEN CONCENTRATIONS IN BREATHING MIXTURES DURING PROLONGED EXPOSURE

A. G. Zhironkin *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 37-45 refs Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 34-41 (For availability see N75-11596 02-52)

Tests were conducted on mice and monkeys in order to study the effect of various concentrations of oxygen in the air, under normal atmospheric pressure and under conditions of an extended stay (10 to 40 days). The results of the investigations revealed that a prolonged existence is possible in mediums containing up to 60 percent oxygen. Author

N75-11602 Joint Publications Research Service, Arlington, Va.
MEDICAL-PHYSIOLOGICAL OBSERVATIONS DURING CONDUCT OF SADKO-2 TEST

Ye. A. Korotayev, V. N. Kuzhelko, and A. I. Starshinov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 46-63 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov V Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 41-58 (For availability see N75-11596 02-52)

Medical support for the Sadko-2 experiment conducted in 1967 in the Black Sea is discussed, along with a detailed description of the organization and conduct of the experiment itself. Recruitment of aquanauts for the project is described, and the results of preliminary biomedical investigations of the effect of prolonged exposure to underwater pressures. Author

N75-11603 Joint Publications Research Service, Arlington, Va.
MEDICAL-PHYSIOLOGICAL STUDIES IN THE IKHTIANDR-67 EXPERIMENT

E. A. Akhlamov, M. L. Barats, N. V. Vaynshteyn, S. A. Gulyar, S. A. Danilchenko, Yu. N. Kiklevich, A. M. Fedorchenko, and A. B. Khabs *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 64-71 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 58-66 (For availability see N75-11596 02-52)

Research techniques are described, along with the basic data obtained during a study of the organism's physiological functions and adaptation requirements under extreme conditions. The research findings show that the changes in the basic functions of an organism under the conditions created by the Ikhtiandr-67 laboratory are slight and do not exceed the limits of compensatory capacities. Stays in underwater habitats of up to 7 days is quite tolerable and has no adverse effect on the health of the aquanauts. Author

N75-11604 Joint Publications Research Service, Arlington, Va.
FEATURES IN THE DESIGNING OF PRESSURIZED UNDERWATER HABITATS AND PROSPECTS FOR THEIR UTILIZATION **c31**

V. N. Shabalin, A. B. Korolev, and V. B. Muravyev *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 72-84 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 66-78 (For availability see N75-11596 02-52)

The underwater habitat Sprut is described in terms of the features involved in the designing of such structures. The uniqueness in the Sprut's design is that the gas medium necessary for life support (in the given case, air) is simultaneously a supporting design element, and at the same time stabilizes the house's form through excess pressure. A comparative analysis of 'soft' and 'hard' houses is presented based on the prospects for equipping mobile expeditions, conducting oceanographic studies, geologic prospecting, magnetic measurements, etc., with such underwater habitats. Author

N75-11605 Joint Publications Research Service, Arlington, Va.
CERTAIN OCEANOGRAPHIC TESTS WITH APPLICATION OF UNDERWATER HOUSE-LABORATORY SPRUT

L. Ye. Ayvazova, A. B. Korolev, V. B. Muravyev, M. V. Fedosov, and V. N. Shabalin *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 86-89 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 78-83 (For availability see N75-11596 02-52)

One of the missions in the Sprut expedition involved a study of the possibility of oceanographic research in an underwater house-laboratory. Results of determining the pH and alkalinity proved comparable both in the underwater and shore-based laboratories. The results of determining the content of dissolved oxygen in the underwater labbratory proved to be 1 m1/1 lower than in the shore-based laboratory. Author

N75-11606 Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR UTILIZATION OF UNDERWATER HOUSES AND CHAMBERS IN DEVELOPMENT OF MARINE OIL DEPOSITS **c31**

I. P. Kuliyev and Yu. P. Vladimirov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 90-93 Transl. into ENGLISH of the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 83-86 (For availability see N75-11596 02-52)

The development of offshore petroleum and gas deposits in the U.S.S.R. and abroad were examined in terms of the actual prospects of utilizing underwater habitat/laboratories for research in industrial hydraulic engineering techniques for construction of offshore platforms. Author

N75-11607 Joint Publications Research Service, Arlington, Va.
UNDERWATER INVESTIGATIONS OF IKHTIANDR CLUB c48

N. A. Akhlamov, Yu. M. Barats, Yu. N. Kiklevich, and A. B. Khayes *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 94-97 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 86-90 (For availability see N75-11596 02-52)

The experiments of the Donetskiy Club, Ikhtiandr, are described including the submergence of underwater houses-laboratories and a study of the functions of the human organism existing for an extended time under unusual conditions in the ambient medium. In the authors' opinion, the problem of developing the continental shelf needs to be solved along the following four lines: (1) a study of the life activity of aquanauts; (2) the development of underwater habitats and systems of their support; (3) the development of technology and procedures for underwater activities; and (4) the creation of new instruments for underwater research. Author

N75-11608 Joint Publications Research Service, Arlington, Va.
UNDERWATER HOUSES IKHTIANDR-66 AND IKHTIANDR-67 c31

Yu. M. Barats, A. G. Zubchenko, A. A. Ivanin, Yu. Yu. Kachuro, Yu. N. Kiklevich, V. I. Pesok, V. G. Rudenko, and G. A. Tunin *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 99-106 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 90-98 (For availability see N75-11596 02-52)

The design of underwater habitats, the Ikhtiandr-66 and Ikhtiandr-67, are presented including the life support systems for man under water. The prospect is validated for the development of equipment for underwater research based on simple, reliable, safe elements in pneumo-automatics. Plans are presented for the further development of the Ikhtiandr underwater research laboratories and the use of the open type of houses with application to problems in marine geology. Author

N75-11609 Joint Publications Research Service, Arlington, Va.
ON A PLAN FOR INTERDISCIPLINARY BLACK SEA UNDERWATER OBSERVATORY OF MOSCOW STATE UNIVERSITY c48

N. V. Vasilchikov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 107-122 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 98-114 (For availability see N75-11596 02-52)

The article clarifies a number of questions associated with the construction of the underwater research observatory. The observatory will be set up in Kalamitskiy Zaliv (Bay) on a bottom sector 10 miles long and 1 mile wide, with depth ranging from 25 to 100 m. The observatory is designed for studying the mutual effect of atmospheric (in the air/water interface), hydrologic, geologic, biologic and other processes over extended time spans. Author

N75-11610 Joint Publications Research Service, Arlington, Va.
ON EXPERIMENT IN BIOLOGICAL OPERATIONS FROM UNDERWATER LABORATORY CHERNOMOR IN 1968 (PRELIMINARY REPORT) c48

N. Ye. Denisov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 123-125 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 114-117 (For availability see N75-11596 02-52)

A technique is described of quantitative biocoenotic studies of benthos from an underwater laboratory (UL). The zone of ecological disturbances introduced into the community by the UL's presence on bottom was determined. It is stressed that the effectiveness of utilizing the UL for biocoenological studies should increase with an increase in depth. Author

N75-11611 Joint Publications Research Service, Arlington, Va.
SCIENTIFIC PROGRAM CHERNOMOR-68 c48

N. A. Aybulatov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 126-130 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 117-122 (For availability see N75-11596 02-52)

The program of oceanographic and physiological research is explained from the underwater laboratory, Chernomor. A brief description is given of the hydrologic, geologic and biological activities performed while using the laboratory as a base. Author

N75-11612 Joint Publications Research Service, Arlington, Va.
CERTAIN QUESTIONS IN ORGANIZATION OF SCIENTIFIC RESEARCH TASKS USING CHERNOMOR UNDERWATER LABORATORY AS A BASE c48

N. A. Aybulatov and V. S. Yastrebov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 131-135 Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 122-127 (For availability see N75-11596 02-52)

A clarification is given of questions relating to organizing the operation of the Chernomor underwater laboratory in 1968, and ways for its improvement are indicated. Author

N75-11613 Joint Publications Research Service, Arlington, Va.
HYDRO-OPTICAL STUDIES IN CHERNOMOR-68 EXPERIMENT (PRELIMINARY REPORT) c48

V. P. Nikolayev and Yu. L. Mashtakov *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 136-142 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 127-133 (For availability see N75-11596 02-52)

A report is given on the hydro-optical studies conducted by the second and fourth research crews on the underwater laboratory Chernomor. The underwater laboratory was stationed on the bottom of Golubaya Bay near Gelendzhik at 14 m depth. A description is given of the underwater laboratory. Author

N75-11614 Joint Publications Research Service, Arlington, Va.
PRESSURIZED UNDERWATER HOUSES AND SHELTERS c31

A. B. Korolev, V. N. Shabalin, and V. B. Muravyev *In its* Some Results and Prospects for the Use of Underwater Habitats in Marine Investigations (JPRS-63261) 23 Oct. 1974 p 143-150 refs Transl. into ENGLISH from the book "Nekotoryye Rezultaty i Perspektivy Primeneniya Podvodnykh Domov v Morskikh Issledovaniyakh" Moscow, Izdatelstvo Nauka Press, 18 Jun. 1973 p 134-142 (For availability see N75-11596 02-52)

The article clarifies the experience gained in developing and operating the air-pressurized underwater structures of the Sprut type. Author

N75-11615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-VAPOR COOLED TARGETS FOR PRODUCTION OF I-123 AT HIGH CURRENT ACCELERATORS

James W. Blue, Kenneth L. Scholz (Cincinnati General Hospital), and Vincent J. Sodd (Cincinnati General Hospital) 1974 15 p refs Presented at the Central Chapter Meeting of the Soc. of Nucl. Med., Minneapolis, 17-19 Oct. 1974
(NASA-TM-X-71620; E-8141) Avail: NTIS HC $3.25 CSCL 06E

The basic elements of the vapor cooled target system are shown. This system can be operated as a heat pipe or as a conventional condenser. The choice of target fluid is based on the specific nuclear reaction chosen to produce Xe-123. The reaction using I-127 was studied and shown to have a significant yield for bombarding energies from 47 to 63 MeV. The Cs-133 reaction is also included. Xenon-123 is applied to I-123 production in a purer form for thyroid studies. J.A.M.

N75-11616*# Linguistic Systems, Inc., Cambridge, Mass.
CARDIOPULMONARY EFFICIENCY IN FORMER AND ACTIVE CHAMPION SCULLERS
F. Dorschner and A. A. Buehlmann Washington NASA Nov. 1974 19 p refs Transl. into ENGLISH from Schweiz. Med. Wochensch. (Switzerland), v. 130, 1973 p 501-508
(Contract NASw-2482)
(NASA-TT-F-15728) Avail: NTIS HC $3.25 CSCL 06P

Cardiopulmonary efficiency was determined in 12 active and 12 former championship scullers grouped according to age, and the results were compared. None of the older subjects had any severe systemic diseases, especially of the lungs or the heart. Circulating blood volume, hemoglobin concentration, hematocrit, arterial blood pressure, alveolo-arterial Po2 gradient, arterial blood gases and lactate concentration were determined at rest, during submaximal work load on a bicycle ergometer and again after recovery. Total and vital capacities were higher than the predicted values, i.e., the residula volume increases with age. Resting blood pressure, resting blood gases, hematocrit and the other above-mentioned, simultaneously performed determinations yielded largely normal results. The 12 active athletes have a significantly higher working capacity and blood volume than the former champions. The cardiopulmonary efficiency of the formerly active group is remarkably higher in relation to the normal population as a result of continual cardiovascular training after retiring from the active sport. Author

N75-11617*# Scientific Translation Service, Santa Barbara, Calif.
HYPERBARIC OXYGENATION
I. P. Berezin Washington NASA Nov. 1974 181 p refs Transl. into ENGLISH of the book "Giperbaricheskaya Oksigenatsiya" Moscow, Meditsina Press, 1974 p 1-128
(Contract NASw-2483)
(NASA-TT-F-15988) Avail: NTIS HC $7.00 CSCL 06P

The characteristics and possibilities of hyperbaric oxygenation were studied. The effect of hyperoxygenation of the organism under various conditions was examined, and periods of same exclusion of circulation when breathing oxygen under increased pressure were measured. Problems of biological and technical safety during the conduct of hyperbaric oxygenation are described. Author

N75-11618# Department of Health, Education, and Welfare, Washington, D.C.
INTERNATIONAL CONFERENCE ON BONE MINERAL MEASUREMENT
Richard B. Mazess, ed. [1974] 416 p refs Conf. held at Chicago, 12-13 Oct. 1973
(DHEW(NIH)-75-683) Avail: NTIS HC $10.50

Photon absorptiometry, Compton scattering, and neutron activation methods for clinical and biomedical bone density measurements are reported. For individual titles, see N75-11619 through N75-11664.

N75-11619 Harvard Medical School, Boston, Mass. Dept. of Radiology.
PHYSICAL ASPECTS OF I-125 BONE ABSORPTIOMETRY
Philip F. Judy *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 1-10 refs (For availability see N75-11618 02-52)

The accuracy of bone mineral absorptiometry using the radionuclide, I-125, as the photon source was found to be determined by hardening the photon beam and variation in the distribution of adipose tissue in the body. The hardening error was estimated to be + or - 2% when the system was calibrated over the biological range of bone mineral mass. The variations of adipose tissue thickness inside the bone and subcutaneously have been shown to depend critically on the method of determining the baseline. The errors caused by the detection of scattered radiation and the finite size of the photon beam have been shown to be less than 1% for a system calibrated by an ash study. Author

N75-11620 Alberta Univ., Edmonton. Div. of Biomedical Engineering.
UNIVERSITY OF ALBERTA BONE MINERAL ANALYSIS SYSTEM: PERFORMANCE AND CLINICAL APPLICATION
T. R. Overton, D. S. Silverberg, W. M. Rigal, and L. Friedenberg *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 11-29 refs (For availability see N75-11618 02-52)

A system for bone mineral content (BMC) measurements using the Cameron photon absorption technique and Am-241 has been developed. This precision scanning device is readily adapted to make measurements at several body sites including the metacarpals, radius, femur and vertebrae. Provision is made for single and for multiple source mounting, and two channels of pulse height analysis and recording are available, permitting the use of both single and dual photon measurement techniques. The studies described concern measurements of bone phantoms and of the femur using an Am-241 photon source. Author

N75-11621 Zurich Univ. (Switzerland). Inst. fuer Biomedizinische Technik.
A METHOD FOR THE DETERMINATION OF THE COMPACTA AREA AND THE MEAN ABSORPTION DENSITY OF HUMAN BONES
P. Ruegsegger, P. Niederer, and M. Anliker *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 30-33 refs (For availability see N75-11618 02-52)

It is possible to determine the bone mineral content to an accuracy of a few percent from noninvasive absorption measurements of soft gamma rays. Extensions of this technique demonstrated that size and shape of the compacta as well as its mean absorption density may also be evaluated in addition to the total mineral content. This is accomplished by repeating the linear scanning process at a given cross-section of the bone thirteen times by rotating the collimated beam of gamma rays through 15 deg after each scan. The range of the linear scan is divided into N = 1000 equal intervals. For scan direction n and interval k the mean pathlength of the gamma beam through the bone section is determined and the corresponding transmission rate of photons is denoted and stored in a computer for further processing. Author

N75-11622 Washington Univ. Hospital, Seattle.
PRELIMINARY REPORT: CORRELATION OF TOTAL BODY CALCIUM (BONE MASS), AS DETERMINED BY NEUTRON ACTIVATION ANALYSIS WITH REGIONAL BONE MASS AS DETERMINED BY PHOTON ABSORPTION
Charles H. Chestnut, III, Eberhard Manske, David Baylink, and Wil B. Nelp *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 34-38 refs (For availability see N75-11618 02-52)
(Contract AT(45-1)-2225; Grants AM-9096; MT-69-20-68; AM-53150-02)

Total body neutron activation analysis (NAA) allows accurate determination of total body calcium (TBC) and precise measurement of calcium balance. A unique measurement of total bone mineral mass is thereby obtained. Measurement of regional bone mass (RBM) by photon absorption using a bone densitometer is relatively rapid, simple and utilizes equipment commercially available. Both techniques provide important and significant data in assessing bone wasting disease and disease therapy. Measurements of RBM at six sites along the radius, ulna and humerus, are compared to TBC; in this way the relative efficacies and correlations of the two techniques are obtained. Results show that TBC in grams can be predicted from bone mass measurements obtained at the radial site; the standard error of estimate for TBC on RBM is 31.81 grams, a 12.4% relative error when calculated from the TBC mean. Author

N75-11623 Brookhaven National Lab., Upton, N.Y. Medical Research Center.
CORRELATION OF RADIAL BONE MINERAL CONTENT WITH TOTAL-BODY CALCIUM IN VARIOUS METABOLIC DISORDERS
S. H. Cohn, K. J. Ellis, I. Zanzi, J. M. Letteri, and J. Aloia *In*

HEW Intern. Conf. on Bone Mineral Meas. [1974] p 39-50 refs Sponsored in part by AEC (For availability see N75-11618 02-52)

Loss of bone mineral content of the skeleton in osteoporosis and in other metabolic disorders can be measured directly by total body neutron activation analysis (TBNAA). The densitometric technique (using monochromatic photons from I-125 applied to the appendicular skeleton) also reflects the loss of bone mineral in osteoporosis. The results of these two techniques are compared in 80 patients with various metabolic disorders and in 9 normal contrast subjects. It is apparent that there is good correlation between total body calcium (TBCa) and bone mineral content (BMC) in all groups studied. The correlation was highest in the normal contrast group (0.97) and alcoholics (0.98) and lowest in osteoporotic patients (0.83) and in renal patients on dialysis (0.84). Author

N75-11624* Wisconsin Univ. Hospital, Madison. Dept. of Radiology (Medical Physics).

PREDICTION OF FEMORAL NECK AND SPINE BONE MINERAL CONTENT FROM THE BMC OF THE RADIUS OR ULNA AND THE RELATIONSHIP BETWEEN BONE STRENGTH AND BMC

Charles R. Wilson *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 51-59 refs (For availability see N75-11618 02-52)

(Grant NGR-50-002-051; Contract AT(11-1)-1422)

CSCL 06P

The bone mineral content (BMC) is extensively used to provide information about the status of an entire skeleton. Changes in BMC are employed to evaluate the effect of various drugs, disease states, weightlessness, exercise, renal dialysis and others on the skeleton. Clinical and functional information is discussed that may be derived from the BMC of a limited region of the skeleton. In particular there is a fairly high degree of correlation between the BMC of the radius or ulna and that of the femoral neck, r about 0.85 and a somewhat lower relationship between the BMC of the radius or ulna and the thoracic vertebrae, r about 0.65. Also the BMC is highly related to the strength of bone at that scan site. Author

N75-11625 Karolinska Institutet, Stockholm (Sweden) Dept. of Medical Engineering.

BONE MINERAL ASSAY: CHOICE OF MEASURING SITES

Nils Dalen *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 60-65 refs (For availability see N75-11618 02-52)

Data are collected by the X-ray spectrophotometric method on the bone mineral content at various sites during different clinical conditions, such as alcoholics, patients with primary hyperparathyroidism, patients with chronic renal failure, non-patients and athletes. The sites were radius and ulna distal and shaft, head of humerus, third lumbar vertebra, femur neck and shaft, and calcaneus. The correlation between different sites in the same individual is weak, and the bone mineral content at the different sites deviates relative to controls in a varying way. Therefore, several sites should be measured to avoid erroneous conclusions. Author

N75-11626 Wisconsin Univ. Hospital, Madison. Dept. of Radiology (Medical Physics).

DIRECT READOUT OF BONE MINERAL CONTENT WITH DICHROMATIC ABSORPTIOMETRY

W. C. Kan, C. R. Wilson, R. M. Witt, and R. B. Mazess *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 66-72 refs (For availability see N75-11618 02-52)

An analog device has been constructed which provides immediate readout of bone mineral content and bone width from absorptiometric scans with two photon beams with different energies such as Gd-153 or I-125/Am-241. The system and preliminary results are presented. Author

N75-11627 Wisconsin Univ. Hospital, Madison. Dept. of Radiology (Medical Physics).

ANALYSIS OF Gd-153 AND OF I-125/Am-241 SOURCES

James Hanson *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 73-79 refs (For availability see N75-11618 02-52)

The precision of the dual photon bone mineral technique was modeled mathematically as an expression based on counting statistics. For a given amount of bone and soft tissue there is an optimal photon energy pair. When the initial intensities of the photon beams are equal, the optimal lower photon energy increases with increasing mass of bone and soft tissue for a given higher photon energy. Dual sources of interest are I-125/Am-241 (28 and 60 keV) and Gd-153 (43 and 100 keV). The bone mineral measured in thin anatomical locations (i.e. hand and forearm) with I-125/Am-241 is more precise than with Gd-153. For thick locations (i.e. upper arm and calf) Gd-153 is more precise than I-125/Am-241. Author

N75-11628 Siemens A. G., Erlangen (West Germany).

DUAL PHOTON X-RAY BEAM APPLICATIONS

K. H. Reiss, K. Killig (Erlangen Univ.), and W. Schuster (Erlangen Univ.) *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 80-87 refs (For availability see N75-11618 02-52)

Two X-ray spectra of different penetration are obtained by switching a normal X-ray generator 5 times a second by means of thyristors. The tube voltage is alternating between about 60 to 90 kV and 150 kV. The higher energy radiation is filtered by an oscillating copper filter of variable thickness so that the intensities of both spectra behind the body are approximately the same. They are measured in a narrow beam by a photomultiplier behind an image intensifier. The quotient of the two intensities delivers a figure for the bone mineral in g/sq cm. Results with excised bones and with patients are presented. Author

N75-11629 Sloan-Kettering Inst. for Cancer Research, New York. Biophysics Lab.

DUAL ENERGY ABSORPTIOMETRY TECHNIQUE FOR BONE MINERAL CONTENT MEASUREMENT

Joseph M. McDonald and Louis Zeitz *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 88-99 refs (For availability see N75-11618 02-52)

(Contracts AT(11-1)-3521; CA-08748)

A dichromatic, or dual energy photon, technique has been developed for the in vivo determination of the mineral content of human bones, in particular the radius and ulna. A dichromatic system, with artificial bone standards and paraffin (simulating fat) in plexiglass, corrected for the presence of the fat component. Corrected integral values had standard deviations from the true values of up to a few percent, while the precision of the technique was approximately two percent for these measurements. Author

N75-11630 Aktiebolaget Atomenergi, Nykoping (Sweden).

BONE MINERAL MEASUREMENTS USING A DICHROMATIC ATTENUATION TECHNIQUE WITH SIMULTANEOUS OPERATION IN TWO ENERGY CHANNELS

Per Schmeling *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 100-107 refs (For availability see N75-11618 02-52)

In vivo measurements of bone mineral using a single gamma energy require the use of water or other issue equivalent substances. The dichromatic technique makes measurements in air possible, as the use of two gamma energies eliminates the influence of soft tissue. Simultaneous operation in two channels with automatic and continuous elimination of soft tissue was demonstrated. The primary results could be obtained directly on a recorder. It was easily possible to measure radius, ulna, humerus, femur, tibia, fibula, and patella. Even the cranium and the spine could be registered. The isotope used was Xe-133, but the results should be applicable to Gd-153 and other isotopes with energies below 100 keV. Author

N75-11631 Mineralogisch-Petrologisches Inst., Bonn (West Germany).

A NEW APPARATUS FOR BONE MINERAL MEASUREMENT IN VIVO

M. Gebhardt and H. Zwicker *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 108-113 refs (For availability see N75-11618 02-52)

An apparatus was constructed which permits absorption measurements on the finger. A finger holder keeps the middle phalanx of the finger in an exact fixable position, whereby the soft tissue parts are slightly pressed between two parallel plexiglass windows. The total width of the finger can be measured with the help of a gauge having a calibration of 0.01 mm. The

bone thickness is determined by a film photograph, whereby the measuring space is kept fixed. Absorption measurements are done with highly stablized X-ray tubes and monochromators rather than radionuclides. Author

N75-11632 Wisconsin Univ. Hospital, Madison. Dept. of Radiology (Medical Physics).
BONE STANDARDS FOR THE INTERCOMPARISON AND CALIBRATION OF PHOTON ABSORPTIOMETRIC BONE MINERAL MEASURING SYSTEMS
Robert M. Witt *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 114-122 refs (For availability see N75-11618 02-52)

Bone standards have been constructed to provide for the intercomparison and calibration of photon absorptiometric bone measuring systems. The standards are composed of polymethyl methacrylate blocks with three annular cavities which are filled with a saturated solution of dipotassium hydrogen phosphate (KHP). The saturated KHP solution has linear attenuation properties similar to those of compact bone. The dimensions of the inner and outer diameters of the annular cavities are similar to the dimensions of the midshafts of radii and metacarpals. The bone mineral content (BMC) of these standards was calibrated by ash bone sections in units of g/cm of bone ash. Author

N75-11633 Harvard Medical School, Boston, Mass. Dept. of Radiology.
ORGANIZATION AND PROCESSING OF BONE MINERAL DATA USING A GENERAL PURPOSE STORAGE AND RETRIEVAL PROGRAM AND A MINICOMPUTER
R. E. Zimmerman, T. Daily, R. Snider, and H. J. Griffiths *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 123-129 refs (For availability see N75-11618 02-52)

The measurement of bone mineral content utilizing the photon absorption method has become routine in a number of major medical centers. An information storage and retrieval program operating on a minicomputer has been used to aid in processing data from over 1780 scans on 985 patients. The program is described along with the human factors involved, source documents, accuracy, reliability and methods of coordinating the data. Author

N75-11634* California Univ., Davis. Dept. of Radiology.
BONE MINERAL COMPUTATION WITH A RECTILINEAR SCANNER
John Ullman, Scott Brown, Alan Silverstein, and John Vogel *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 130-141 refs (For availability see N75-11618 02-52)
(NASA Order T-93591; NASA Order T-81073)
CSCL 06B

A portable rectilinear transmission scanner and associated computerized data reduction techniques for estimating bone mineral content are described. This unit can be easily disassembled for transport to various measurement sites and has been used to estimate the bone mineral content of the os calcis, radius, and ulna in the Apollo and Skylab astronauts. The scanner is used to obtain multiple rows of data from which a bone profile is derived. Bone edges are determined with the aid of a digital computer program which employs an algorithm that determines the greatest rate of change of the counting rate. Author

N75-11635 Freie Univ., Berlin (West Germany).
A COMPUTERIZED METHOD OF DETERMINATION OF BONE MINERAL CONTENT BY A TRANSMISSION-SCANNER: DESCRIPTION OF THE SYSTEM
Udo Schneider and Dietrich Banzer *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 142-150 (For availability see N75-11618 02-52)

Based on the method of Cameron and Sorenson a transmission scanner has been developed including a movable X-ray tube. Additional information about geometry and structure of the bone which has been examined is obtained by several radiographs in the plane of measurement. The data is evaluated by a computer and is stored on magnetic tape, together with clinical information. Automatic reports for the physician are printed and scientific evaluation is possible by several programs. With special equipment the bones of small animals are measured. Most of the human measurements were done on the calcaneus. Normal ranges for this bone were evaluated. Author

N75-11636 Harvard Univ., Cambridge, Mass. Cyclotron Lab.
IN VIVO CALCIUM DETERMINATION BY PROTON ACTIVATION ANALYSIS
Richard Eilbert *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 151-154 (For availability see N75-11618 02-52)
(Grant NSF GI-38443)

Proton activation of Ca-40 in bone produces K-38. This radionuclide undergoes beta decay, emitting a 2.17 MeV gamma ray with a half life of 7.7 minutes. Knowledge of the proton flux and efficient detection of the subsequent gamma radiation allow a precise determination of calcium in vivo. Localization of dose is made possible by the finite range of protons and their resistance to scattering sideways because of their heavy mass. Collimators can be constructed to restrict the field of irradiation to any desired shape in the transverse plane. Proton flux is determined from a monitor ionization chamber placed upstream from the final collimator. By using pre-absorbers, any proton energy less than 160 MeV can be attained at the skin. Tissue dose is correspondingly limited to any desired penetration depth less than 18 cm. Author

N75-11637 Edsel B. Ford Inst. for Medical Research, Detroit, Mich. Physics and Biophysics Dept.
AN EVALUATION OF SEVERAL NUCLIDES FOR BONE DENSITY DETERMINATIONS BY COMPTON SCATTERING
Dennis G. Piper, Luther E. Preuss, and Frank P. Bolin *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 155-160 refs (For availability see N75-11618 02-52)

The isotopes available for use in the Compton scattering method of determining bone density are considered. System performance for this technique is optimum at an energy of about 90 keV, dropping off by a factor of two at about 200 keV. In accordance with this conclusion, only those isotopes with gamma energies of 80 to 200 keV are investigated. Some of the isotopes had several emissions which would interfere with the desired energy, or were too expensive to produce. The nuclides studied were Ba-133, Tm-170, Cd-109, Eu-155, Gd-153, Ag-108, Co-57, Se-75, Ce-144, Ce-139, Sb-125, and Ho-166. Author

N75-11638 Erlangen-Nuremberg Univ. (West Germany).
CORRELATION OF OS CALCIS AND SPINAL BONE BY COMPTON SCATTERING
Robert Luther *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 161-168 refs (For availability see N75-11618 02-52)

The mineral contents of 50 os calcis and 50 spines have been measured simultaneously using the Compton scattering method. The results were established statistically. Investigations in vitro showed that the mineral is so inhomogeneously distributed in the os calcis that a single measurement is not able to provide any information about the average hydroxyapatite (HA) precentage of this bone. The investigations into the HA-precentage of the spine revealed a statistically significant negative correlation with age. Comparative investigations on the HA-percentage of os calcis and spine showed that although calcar bone contains much spongiosa there was not a significant correlation between the two. Author

N75-11639 Wright State Univ. Research Inst., Dayton, Ohio. Radiological Research Lab.
PROGRESS IN RADIOGRAPHIC PHOTODENSITOMETRY
Charles Colbert and Richard S. Bachtell *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 169-176 (For availability see N75-11618 02-52)

To determine the skeletal status of a patient and his response to therapy we obtain radiological estimates of bone weight, size, and density from a pair of radiographs and compare these with age-and sex-matched control values. The X-ray film image is scanned by a micro-densitometer connected on-line to a small computer which prints out a skeletal status report based on findings from two films of the same fingers. The second film, taken at kilovoltage and exposure settings different from the first, is used to confirm the findings. Author

N75-11640 Chicago Univ. Hospitals and Clinics, Ill. Dept. of Radiology.
SKELETAL DEMINERALIZATION IN PRIMARY HYPERPARATHYROIDISM
Harry K. Genant, Jean VanderHorst, Lawrence H. Lanzl, Jay C.

Mall, and Kunio Doi *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 177-194 refs (For availability see N75-11618 02-52)

Skeletal mineralization has been assessed in 87 patients with primary hyperparathyroidism. Qualitative studies included a review of conventional radiographs of the spine and hands, and an analysis of fine detail radiographs. Quantitative assessment included radiographic morphometry using the cortical thickness of the second metacarpal, and photon absorptiometry using the linear absorption coefficient of overall bone in the phalanx. The results indicate that: (1) radiographic osteopenia in primary hyperparathyroidism is uncommon and difficult to assess; (2) fine detail radiography demonstrates excessive bone resorption undetected on conventional radiographs; (3) quantitative analyses using metacarpal cortex and phalangeal mineral content reveal bone loss in a majority of hyperparathyroid patients. Author

N75-11641 Glostrup Hospital, (Denmark). Dept. of Clinical Physiology.

ANTICONVULSANT OSTEOMALACIA

Claus Christiansen and Paul Rodbro (Aalborg Sygehus Syd, Denmark) *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 198-205 refs (For availability see N75-11618 02-52)

The bone mineral content related to total body calcium was estimated by photon absorptiometry in 226 epileptic patients on long term treatment with phenytoin, phenobarbitone or primidone, and in 20 normal subjects before and during treatment with vitamin D sub 2 or placebo. Initially subnormal values of bone mineral content were found in the epileptic patients. The group of epileptic patients showed on treatment with vitamin D sub 2 a significant increase in bone mineral content. The group of epileptic patients treated with placebo and the normal subjects treated with vitamin D sub 2 or placebo showed no change in bone mineral content. Author

N75-11642 Freie Univ., Berlin (West Germany). Klinikum Steglitz.

A COMPUTERIZED METHOD OF DETERMINATION OF BONE MINERAL CONTENT BY A TRANSMISSION SCANNER

Dietrich Banzer and Udo Schneider *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 206-213 (For availability see N75-11618 02-52)

Measurements on patients with chronic renal disease, including those on hemodialysis or post renal transplant, showed a bone mineral loss of up to 50%. The mineral content of the os calcis depends on the duration of the disease as seen in follow-up studies over two years. About 50 measurements on patients with disturbance of the ovarial function showed a significant demineralization and characteristic changes of bone density under therapy with estrogens. A decrease of bone mineral content was also seen in patients with hyperthyroidism, thyroidectomy, rheumatic diseases, vascular diseases, and fractures of the lower extremities. A post-operative follow-up study after parathyroidectomy demonstrates the prognostic value of the method in hyperparathyroidism. Author

N75-11643 University Hospital, Basel (Switzerland). Div. of Metabolism.

BONE MINERAL LOSS IN PRE-MENOPAUSE

K. R. Heer, A. Roesli, Th. Lauffenburger, J. Guncaga, M. A. Dambacher, and H. G. Haas *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 214-221 refs (For availability see N75-11618 02-52)

The bone mineral content (BMC) in the pre-menopause was assessed by absorptiometry in 83 normal women aged 48 to 54 and 40 normal female subjects aged 38 to 44. A modification of the scanning procedure proved to be necessary in order to obtain reproducible results. Cortical BMC values of the right radius correlated with roentgenographic findings of the lumbar spine obtained by a standardized technique. No such correlation was found for the trabecular BMC values in the younger age group. The average cortical BMC was the same in both age groups, but bone mineral loss appears to be a nonuniform process. Some subjects may be more sensitive to a decreasing ovarian function in pre-menopause; they may lose bone mineral earlier and/or more rapidly. Author

N75-11644 Washington Hospital Center Washington, D.C. Dept. of Endocrinology.

A PRELIMINARY EVALUATION OF DIAGNOSIS AND THERAPY IN OSTEOPOROSIS

Jay R. Shapiro, W. Tabb Moore, Hildegard Jorgensen (Howard Univ., Washington, D. C.), Charles Epps (National Inst. of Arthritis, Metabolism, and Digestive Disease, Bethesda, Md.), Jeanne Reid (National Inst. of Arthritis, Metabolism, and Digestive Disease, Bethesda, Md.), and G. Donald Whedon *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 222-224 refs (For availability see N75-11618 02-52)

(Grant RR-05361)

The Norland Bone Mineral Analyzer is evaluated in terms of its diagnostic accuracy in the patient with osteoporosis and a new therapeutic regimen in osteoporosis is discussed. The regimen involved the use of a 2400 milligram calcium, 2200 milligram phosphorus intake. In the later stages of this study, oral vitamin D sub 2 was added. Bone was scanned with the mineral analyzer at two sites: the proximal site was 8 centimeter cephalic to the head of the radius while the distal site was 3 centimeter cephalic to the head of the radius. Proximal-distal mineral content ratios for normals, hyperparathyroids, and osteoporotic patients showed a great degree of overlap for both sex and race groups. While greater loss of distal was seen in occasional patients, the use of this ratio did not serve to discriminate the osteoporotic patients from normals. Author

N75-11645 Mayo Clinic, Rochester, Minn. Dept. of Laboratory Medicine.

PHOTON ABSORPTION METHOD AND SINGH INDEX IN THE DETECTION OF OSTEOPOROSIS: A COMPARATIVE STUDY

H. W. Wahner, B. L. Riggs, and J. W. Beabout *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 225-227 refs (For availability see N75-11618 02-52)

Compared are estimates on bone mineral content for the photon absorption method of Cameron and the skeletal grading method of Singh in their abilities to separate normal females over 45 from females of the same age but with compression fractures of the spine. There was no difference between the normal and the osteoporosis population by bone mineral determination with the Cameron method at the mid-radius. However, a significant separation between the two populations was seen at the distal scanning site. A significant overlap between the two populations, however, limits the usefulness of the procedure for routine clinical diagnosis. A better separation was achieved with the Singh index. Eighty-two percent of all normal subjects over 45 years had index values 5 or above. It is concluded that the evaluation of the trabecular structure of the femur better and perhaps earlier reflects spinal changes in osteoporosis, than the bone mineral determination by the Cameron method. Author

N75-11646* Wisconsin Univ. Hospital, Madison. Dept. of Radiology.

BONE MINERAL CONTENT IN NORMAL US WHITES

Richard B. Mazess and John R. Cameron *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 228-238 refs (For availability see N75-11618 02-52)

(Grant NGR-50-002-051; Contract AT(11-1)-1422)

CSCL 06P

Photon absorptiometry with I-125 was used to measure the bone mineral content and the bone width on 763 children between the ages of 5 and 19 years, on 538 adults between the ages of 20 and 49 years, and on 550 adults over the age of 50 years. Measurements were made on the midshaft and the distal end of the radius and the ulna, and on the humerus midshaft. This has permitted analysis of annual bone growth in children, and the rate of change in elderly adults per decade. Male and female children grew at about the same rate until adolescence. After adolescence females grew at a slow rate until the mid-twenties, while males reached adult mineralization by age 20. Males remained relatively constant until the fifties, and females began their decline in the forties. Author

N75-11647 Goldsmith (N. F.), Reston, Va.

NORMATIVE DATA FROM THE OSTEOPOROSIS PREVALENCE SURVEY, OAKLAND, CALIFORNIA, 1969-1970.

BONE MINERAL AT THE DISTAL RADIUS: VARIATION WITH AGE, SEX, SKIN COLOR, AND EXPOSURE TO ORAL CONTRACEPTIVES AND EXOGENOUS HORMONES; RELATION TO AORTIC CALCIFICATION, OSTEOPOROSIS, AND HEARING LOSS

N. F. Goldsmith *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 239-266 refs (For availability see N75-11618 02-52) (Grants PH-86-68-181; HS-00288)

The prevalence of osteoporosis was evaluated in 8,434 persons; A low degree of mineralization was found in lactators, women undergoing early menopause, and nonusers of hormones, and in association with fracture, aortic calcification, and vertebral osteoporosis. A high degree of mineralization was associated with bilateral hearing impairment in older men and was found in younger women after childbearing or the use of high mestranol contraceptives, in older women after treatment with sulfated estrogens, and in all women after treatment with all steroid hormones and thyroid. The major determinants of bone mineral at the distal radius were age, sex, parity, early menopause, skin color, exogenous hormone usage, and lactation. Author

N75-11648 Geneva Univ. (Switzerland). Div. of Nuclear Medicine.

INFLUENCE OF THE NATURAL CALCIUM AND FLUORIDE SUPPLY AND OF A CALCIUM SUPPLEMENTATION ON BONE MINERAL CONTENT OF HEALTHY POPULATION IN SWITZERLAND

A. Donath, P. Indermuehle, and R. Baud *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 267 (For availability see N75-11618 02-52)

The bone mineral content was measured of 3000 inhabitants of the city of Geneva and of people living in Swiss mountain villages where water is naturally fluoridated and contains about 10 mg F/liter. There was not any significant difference in bone mineral content. Author

N75-11649 Indiana Univ., Indianapolis. Dept. of Medicine.

MINERAL LOSS WITH AGING MEASURED PROSPECTIVELY BY THE PHOTON ABSORPTION TECHNIQUE

David M. Smith, M. R. A. Khairi, and C. Conrad Johnston, Jr. *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 268-276 refs (For availability see N75-11618 02-52) (Grant AM-07126)

Rates of loss of bone mass were estimated in a group of 27 post-menopausal females followed for 2.4 years. Measurements of bone mass were performed at midshaft and distal sites on the radius by the photon absorption technique. The rates of loss were -.0237 gm/cm/yr for the distal site and -.0117 gm/cm/yr for the midshaft sites. Rates predicted from a population survey of 214 aged matched Caucasian females approximated those observed in the prospective study. From these data estimates of size of treatment and control groups needed to demonstrate a reduction in the rates of loss were made. It is concluded that the photon absorption technique can be feasibly utilized to demonstrate drug effects on the age related loss of bone mass. Author

N75-11650 Hamburg Univ. (West Germany). Abteilung Klinische Osteologie.

BONE MINERAL DETERMINATION OF RADIUS, ULNA, AND FINGERBONES BY I-125 PHOTON ABSORPTIOMETRY ON HEALTHY PERSONS

F. Kuhlencordt, J. D. Ringe, H. P. Kruse, and A. V. Roth *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 277-281 refs (For availability see N75-11618 02-52)

The Norland bone mineral analyzer was used on 140 healthy persons, i.e. 77 women and 63 men, in order to obtain normal values for our population. The site measured was at a point 1/3 the distance from the distal end of the radius. Also measured was the corresponding site of the ulna and across the middle of the basic phalanx of the second, third, and fourth finger. A small mineral loss between the 35th and 65th year of life was found; this loss was more important in women. Author

N75-11651* Minnesota Univ., St. Paul. College of Veterinary Medicine.

TIBIAL BONE MINERAL DISTRIBUTION AS INFLUENCED BY CALCIUM, PHOSPHORUS, AND VITAMIN D FEEDING LEVELS IN THE GROWING TURKEY

Francis A. Spurrell, Juan Brenes, and Paul Waibel *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 282-284 Sponsored in part by AEC (For availability see N75-11618 02-52) (Contract NAS2-7375)
CSCL 06C

Roentgen signs, subperiosteal, endosteal, and trabecular bone growth are evaluated in turkeys fed phosphorus at the 0.5, 0.56, 0.68, 0.90, and 2.70 percent levels. Calcium levels of 0.30, 0.40, 0.60, 1.2, and 3.60 percent were also tested. Vitamin D levels of 0, 100, 300, 900 and 27,000 I.U. per day were likewise evaluated. Roentgen signs, bone mineral as measured by T-125 gamma ray absorption, and bone mineral growth patterns as shown by radiograph area projection are correlated with calcium, phosphorus, and vitamin D feeding levels. Differences in bone growth at the various feeding levels were observed which were not reflected by differences in other studied parameters. Author

N75-11652 Veterans Administration Hospital, Sepulveda, Calif.

DIETARY CALCIUM AND THE JAW BONE

Leo Lutwak and Ann Coulston *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 285-292 refs (For availability see N75-11618 02-52)

Previous work with animals demonstrated that periodontal disease with associated demineralization of the jaw was a precursor of generalized systemic osteoporosis. A pilot study in human subjects with periodontal disease confirmed an animal project which had demonstrated reversal of the clinical signs of this disorder by supplementation of the diet with calcium. In the present study 90 adult subjects with periodontal disease received either placebo or 1 gm calcium per day for 12 months. Densitometry of the os mentis showed a highly significant increase in bone density in the patients receiving calcium supplementation for 12 months. Author

N75-11653 Naval Medical Research Inst., Bethesda, Md. Tissue Bank Div.

TRANS-IMAGING OF BONE ALLOGRAFTS: A RAPID METHOD FOR EVALUATING OSSEOUS INCORPORATION

Robert W. Bright, Vincent L. McManaman (Armed Forces Radiobiology Research Inst., Bethesda, Md.), and Alfred M. Strash (Medical College of Virginia, Richmond) *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 293-301 refs (For availability see N75-11618 02-52)

Quantitative evaluation of graft incorporation is required in order to assess and direct the post-operative care of a patient. Rectilinear scanning with Am-241 and high performance gamma camera were used to image the entire extremity area; maximum utilization of the grid was accomplished by focusing the source and bone specimen some distance from the camera. A computer was then repeatedly directed to bisect the image and to plot the multiple scans from the single image. Bone mineral content throughout the graft and surrounding host bone was then determined, and this data was stored for comparison with sequential scans. It is felt that this method can play an important clinical role in patient care as well as provide the researcher with a better tool for evaluating and selecting the best possible grafting material. Author

N75-11654 Argonne National Lab., Ill.

EFFECTS OF SKELETAL RADIUM DEPOSITS ON BONE MINERALIZATION

Robert A. Schlenker and Billie G. Oltman *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 302-316 refs (For availability see N75-11618 02-52)

Measurements of bone mineralization are reported for 281 women over 40 who have abnormally high body burdens of radium. The measurements were made at the midshaft and distal end of the radius. No significant differences are found in the bone mineralization between women with body burdens less than 0.003 micron Ci and with body burdens between 0.003 and 0.1 micron Ci. The rate of demineralization in women over 60 who have body burdens greater than 0.1 micron Ci is twice as great as in women over 40 who also have body burdens but less than 0.1 micron Ci. The difference in rates of demineralization is statistically significant at the 95% level. Bilateral symmetry of mineralization is not significantly disturbed by skeletal radium

deposits in right-handed women, when the body burden is less than 0.1 micron Ci. Author

N75-11655 Erlangen-Nuermberg Univ. Childrens Hospital (West Germany).
FOLLOW-UP EXAMINATION OF THE MINERAL SALT CONTENT IN THE SKELETON WITH VARIOUS VITAMIN D RESISTANT FORMS OF RICKETS OF RENAL ORIGIN
W. Schuster *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 317-324 refs (For availability see N75-11618 02-52)

With the aid of experimental facilities specially developed for pediatric requirements, 7 patients with chronic phosphatic diabetes, 7 children with uremic osteodystrophy, 3 patients with the De Toni-Fanconi syndrome and 1 patient with distal tubular acidosis of the Albright type were examined during to determine the mineral salt content in peripheral parts of the skeleton. The results of the long-term follow-up reveal the different responses to the therapeutic measures so far possible, in the case of the various vitamin D-resistant forms of rickets of renal origin. In chronic phosphatic diabetes, even long term treatment fails to replenish the calcium deposits in bones to any noticeable extent. With the other diseases therapy brings about, are increase of the mineral salt concentration in the skeleton. Author

N75-11656 Leeds Univ. (England). Biological Research Unit.
CHANGES IN SKELETAL MINERAL IN PATIENTS WITH RENAL FAILURE
P. J. Atkinson, F. M. Parsons, G. W. Reed, and D. A. Hancock *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 325-336 refs (For availability see N75-11618 02-52)

Bone measurements have been made at regular intervals over several years on 15 patients with renal failure, using a technique that employs the 60 keV emission of Am-241 scanned across the femoral shaft. Individual patients, show different degrees of bone mineral change. In some cases, vitamin D therapy not only prevented bone loss but also enhanced bone mineralization. Patients having bad bilateral nephrectomy showed a tendency to lose bone and this may perhaps have reflected a deficiency of 1,25 dihydroxycholecalciferol. Two transplanted patients, on the other hand, also showed a tendency to lose bone rapidly. Author

N75-11657 Harvard Medical School, Boston, Mass.
THE ROLE OF PHOTON ABSORPTIOMETRY IN THE DIAGNOSIS AND FOLLOW-UP OF PATIENTS WITH RENAL FAILURE
Harry J. Griffiths and Robert E. Zimmerman *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 337-345 refs (For availability see N75-11618 02-52)

Using a I-125 photon absorption method to measure bone mineral, 800 measurements have been performed on the cortical bone of the lower arm in 382 patients with renal failure representing every stage of the disease. The following conclusions can be drawn from the data: (1) prolonged azotemia leads to severe loss of bone mineral which, in the early stages, is only detectable using photon absorptiometry; (2) there is inexorable loss of bone mineral while the patient is on dialysis; (3) parathyroidectomy may slow this loss of bone mineral but fails to correct the osteomalacia; (4) after transplantation the rate of bone loss will either decrease or cease. Author

N75-11658 Harvard Medical School, Boston, Mass. Dept. of Radiology.
THE CORRELATION OF RADIOGRAPHIC BONE SURVEYS WITH BONE MINERAL VALUES OBTAINED USING A PHOTON ABSORPTIOMETRIC TECHNIQUE IN A GROUP OF 315 PATIENTS WITH CHRONIC RENAL FAILURE: A PRELIMINARY REPORT
Harry J. Griffiths, R. E. Zimmerman, and G. Bailey *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 346-351 (For availability see N75-11618 02-52)

Radiographic and absorptiometric measurements were done on 315 patients at all stages of renal failure. Bone mineral was subnormal in 32% of the patients. Various components of renal osteodystrophy occurred in combinations, and were often associated with a decrease in the bone mineral content. Both radiographic and absorptiometric studies should be performed at three month intervals, if the patient has normal bone and more frequently if bone mineral starts to decrease. Author

N75-11659* California Univ., Davis. Dept. of Radiology.
BONE MINERAL CHANGES IN THE APOLLO ASTRONAUTS
John Max Vogel *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 352-361 refs (For availability see N75-11618 02-52) (NASA Order T-93591)
CSCL 06P

Loss of mineral from bone during periods of immobilization, recumbency or weightlessness have been observed. These losses are more apparent in the lower extremity than the upper and have been observed to exceed 30% in the case of the central os calcis during 36 weeks of bedrest. In early Gemini studies using X-ray densitometry, large losses of bone mineral were observed in the radius and ulna. This observation was not validated in the Apollo 14, 15 and 16 crewmen when a more precise technique, gamma ray absorptiometry, was used. The large losses reported for the early Gemini missions were not seen when this new measuring technique was employed. Author

N75-11660 Malmoe General Hospital (Sweden). Dept. of Orthopedic Surgery.
BONE MASS AND COLLE'S FRACTURE
Bo E. Nilsson and Nils E. Westlin *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 362-368 (For availability see N75-11618 02-52)

Epidemiological studies of Colle's fracture suggest a strong age dependence, particularly in women. Furthermore, a significant coincidence between Colle's fracture and femoral neck fracture has been demonstrated and it may be assumed that the former is an early and the latter a late sign of bone fragility. Even if, in the present study, there was a small difference in bone mass between fractured and un-fractured women, this difference was not significant on the fracture site. It might therefore be assumed that Colle's fracture is a symptom of decreased bone quality which occurs before any appreciable loss of bone mineral has taken place. Author

N75-11661 New York Univ. Medical Center. Dept. of Biochemical Pharmacology.
CHANGES IN BONE MINERALIZATION IN HEMIPLEGIA
C. H. Marshall, A. T. Viau, L. Berkovits, W. S. Davis, D. S. Chu, and N. E. Naftchi *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 369-379 refs (For availability see N75-11618 02-52)

Hemiplegia is characterized by paralysis on one side of the body. In order to relate bone mineral changes to the effect of paralysis, the non-paralyzed side was used as a control for the paralyzed side. The bone mineral content was measured in 43 hemiplegic subjects matched for age and sex, using a modified Packard device with I-125 as the source. The bone density was compared bilaterally at two sites on radius and ulna, two and four centimeters from the wrist. The results at equivalent sites were expressed as the ratio between the absorption on the paralyzed and non-paralyzed sides. Regression analysis of the relationship between this ratio and time indicated that the rate of loss of mineral from the paralyzed side was 5% + or - 2.5% per 100 days. Author

N75-11662 Western Ontario Univ., London. Faculty of Physical Education.
BONE GROWTH AND PHYSICAL ACTIVITY IN YOUNG MALES
Ronald C. Watson *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 380-386 refs (For availability see N75-11618 02-52)

Photon absorptiometry was utilized to probe the relationship between bone mineral content and the physical activity of amateur baseball players. The study focused principally upon the dominant non-dominant differences in mineral content within age groups and the changes in this variable over age. Upper and lower arm limb girths as well as grip strength were measured to validate physical stress dominance. The most consistent finding throughout the investigation was that the dominant humerus was significantly more mineralized for all age groups and the degree of dominance increased significantly with age. This characteristic held when

the influence of bone size was accounted for by testing the mineral/width ratio. The patterns for mineral dominance of the radius and ulna were inconsistent. Author

N75-11663 Wayne State Univ., Detroit, Mich. School of Medicine.
THE EFFECT OF DIPHOSPHONATE THERAPY ON THE BONE LOSS OF IMMOBILIZATION
A. Robert Arnstein, Frank S. Blumenthal, John A. Bevan (Proctor and Gamble, Inc.), Scotte Michaels (Proctor and Gamble, Inc.), and Daisy S. McCann (Michigan Univ.) *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 387-396 refs (For availability see N75-11618 02-52)

In this group of men with quadriplegia and paraplegia due to spinal cord trauma, 12 weeks of treatment with EHDP prevented a negative bone mineral balance in the distal tibial diaphysis as measured by I-125 photon absorption, but did not prevent apparent qualitative radiographic progression in the tibial metaphysis. In addition, high pre-treatment levels of serum iPTH were found in some of these patients and remain unexplained. They tended to increase with time and this increase was not related to treatment with EHDP or its associated hyperphosphatemia. Author

N75-11664 Wisconsin Univ., Madison. Dept. of Preventive Medicine.
THE EFFECTS OF PHYSICAL ACTIVITY ON BONE IN THE AGED
Everett L. Smith *In* HEW Intern. Conf. on Bone Mineral Meas. [1974] p 397-407 refs (For availability see N75-11618 02-52)

The hypothesis that physical activity effectively slows the progress of bone loss and causes bone accretion in the aged was supported by the results of this study. Physical activity slowed the normal process of bone loss, as seen by bone mineral increases of the physical activity group (2.6%) and the physical therapy group (7.8%). When compared to the control group, the physical activity group, while demonstrating a positive increase, was not significant for the 8 month period of the study; the physical therapy group when compared to the control group was significant. Author

N75-11665*# Vermont Univ., Burlington. Dept. of Electrical Engineering.
PROCESSING ELECTROPHYSIOLOGICAL SIGNALS FOR THE MONITORING OF ALERTNESS Annual Report, 1 Oct. 1973 - 30 Sep. 1974
David C. Lai Nov. 1974 39 p refs
(Grant NGR-46-001-041)
(NASA-CR-140815) Avail: NTIS HC $3.75 CSCL 05E

Mathematical techniques are described for processing EEG signals associated with varying states of alertness. Fast algorithms for implementing real-time computations of alertness estimates were developed. A realization of the phase-distortionless digital filter is presented which approaches real-time filtering and a transform for EEG signals. This transform provides information for the alertness estimates and can be performed in real time. A statistical test for stationarity in EEG signals is being developed that will provide a method for determining the duration of the EEG signals necessary for estimating the short-time power or energy spectra for nonstationary analysis of EEG signals. Author

N75-11666# New York State Veterinary Coll., Ithaca. Dept. of Physical Biology.
MECHANISM OF CALCIUM ABSORPTION AND TRANSPORT: THE INVOLVEMENT OF THE VITAMIN D-INDUCED CALCIUM-BINDING PROTEIN
A. N. Taylor 1973 11 p refs Presented at the Nutr. Conf., Atlanta, 14 Feb. 1973 Sponsored by AEC
(COO-3167-95; Conf-730229-1) Avail: NTIS HC $3.25

A review of recent developments in the study of calcium absorptive mechanisms emphasizes the end result of vitamin D administration, i.e., the mediation of the calcium absorptive process for which the route of vitamin D, acquired either from dietary sources or from ultraviolet irradiation to the skin, was traced. The process, observed to involve numerous target organs, is shown to induce synthesis of the protein CaBP. The mechanism of delivering these metabolic products to the blood supply is also discussed. Author

N75-11667# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETERMINATION OF THE ADDITIONAL LOAD TO WHICH THE LUNGS OF AN INDIVIDUAL WEARING BREATHING EQUIPMENT ARE EXPOSED
L. Chretien, Y. LeBourdonnec, and B. Werderer Dec. 1973 58 p refs In FRENCH
(CEA-N-1681) Avail: NTIS Avail: AEC Depository Libraries HC $6.00

A knowledge of the additional load imposed on the lungs of an individual wearing breathing protection apparatus is important for the determination of what work the wearer of such equipment can be expected to carry out. The different experimental methods proposed in recent research are described and comparisons are made. Investigations made of the behavior of the different apparatus led to the use of analogies between mechanical and electrical laws. Three types of apparatus were studied using a dynamic method. These apparatus are classified in terms of the physical activity exerted by an operator working in a polluted area and the period of time during which he is exposed. NSA

N75-11668# Environmental Health Lab., McClellan AFB, Calif.
INDUSTRIAL HYGIENE EVALUATION OF SPRAY APPLICATIONS OF POLYURETHANE COATINGS
Ronald D. Burnett and Philip Diamond Nov. 1973 68 p refs
(EHL Proj. M-HAF-311)
(AD-784843; EHL-M-73M-10) Avail: NTIS CSCL 06/10

The report presents the results of the industrial hygiene evaluations conducted in the aircraft painting facility (Bldg 692) at McClellan AFB, California. The building is a large hangar type structure specifically designed for spray painting aircraft. The building has a downdraft ventilation system with air being supplied through numerous ceiling diffusers and exhausted through floor grills. Painters: exposures or potential exposures to airborne concentrations of organic solvent vapors, hexamethylene diisocyanate (HMDI), toluene diisocyanate, and particulates were determined. The highest exposures to solvent vapors occurred during the cleaning of aircraft surfaces with solvent soaked rags. HMDI was the only contaminant generated in excessive concentrations during the spray painting operations. The adequacy of protective clothing and building ventilation was also studied. (Modified author abstract) GRA

N75-11669# Naval Intelligence Support Center, Washington, D.C. Translation Div.
CONDITIONED CONTROL OF CARDIAC ACTIVITY AND RESPIRATION AND MORPHOLOGICAL CHANGES IN THE BRAIN OF PIGEONS UNDER THE ACTION OF A CONSTANT MAGNETIC FIELD
M. I. Yakovleva and M. V. Medvedeva 31 Jul. 1974 10 p refs Transl. into ENGLISH from Zh. Vyssh. Nerv. Deyatel. (USSR), v. 22, no. 2, 1972 p 288-293
(AD-784798; NISC-Trans-3569) Avail: NTIS CSCL 06/19

Published data indicate that a constant magnetic field (CMF) affects the cardiac-circulatory system of both humans and animals. Exposure to a magnetic field induces changes in the functional states of the higher parts of the central nervous system (CNS). In an organism's complex system of adaptive reactions, an essential role is played by the conditioned reflexes in regulating the vegetative functions. This fact has led to the investigation of the effect of a CMF on the conditioned reflexes in regulating cardiac activity and respiration. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N75-11670*# Scientific Translation Service, Santa Barbara, Calif.
ESTIMATING THE EFFECTIVENESS OF HUMAN WORKING CAPACITY UNDER SPACEFLIGHT CONDITIONS
G. T. Beregovoy, N. V. Krylova, I. B. Solovyeva, and G. P. Shibanov Washington NASA Nov. 1974 16 p refs Transl. into ENGLISH from Vop. Psikhologii (USSR), no. 4, Jul. - Aug. 1974 p 3-9

(Contract NASw-2483)
(NASA-TT-F-16019) Avail: NTIS HC $3.25

A theoretical approach to the evalutation of a cosmonaut's psychological reserves and psychophysiological functioning in the space man-machine system is outlined. Due to the greater independence of the man-machine system in space, the cosmonaut must be capable of performing as an observer, operator, repairman and as a working reserve on the spacecraft. The ideal function of the cosmonaut in the latter three roles is described in terms of four basic steps used in human factors engineering: information search, situation evaluation, decision-making, and decision implementation. An extreme situation or accident is the best background for evaluating psychological preparedness; both physical and emotional stress situations are simulated for this purpose, e.g., parachute jumping, escaping submarines by means of torpedo tubes, etc. Correlation of function quality indices with psychophysiological indices will permit prediction of the functional state and emotional behavior of the cosmonaut in space.
Author

N75-11671# Pittsburgh Univ., Pa. Dept. of Occupational Health.
NEGATIVE WORK IN EXERCISE STINTS AND SHORT HEAT EXPOSURE FOR ACCLIMATION Final Report, 1 May 1971 - 31 Jul. 1974
Eliezer Kamon and Harwood S. Belding 31 Jul. 1974 23 p refs Sponsored by ONR
(AD-783715) Avail: NTIS CSCL 06/19

Eighteen young adults were subjected to daily treatments of 30 minutes of either light negative and/or moderate to heavy positive work on a laddermill at 22C followed by 30 minutes of either 3.5 mph walk at 50C/25C db/wb room temperatures or sitting under these ambient conditions with additional radiant heat, for four days. Their state of acclimatization was tested by exposure, up to 120 minutes, to 50C/25C db/wb using the following specific criteria: tolerance time (t) to 3.5 mph walk; evelation of heart rate (HR) and rectal temperature (Tre); fall in mean skin temperature (Tsk); and change of sweating. A method of stints of exercise at room temperature followed by short heat exposures might prove an efficient method of acclimatization for large groups when time and hot spaces are wanting. GRA

N75-11672# Technology, Inc., San Antonio, Tex. Life Sciences Div.
TESTING PSYCHOMOTOR PERFORMANCE DURING SUSTAINED ACCELERATION Final Report, 1 Mar. 1971 - 28 Feb. 1973
Stanley C. Collyer Dec. 1973 63 p refs
(Contract F41609-71-C-0009; AF Proj. 9730)
(AD-784936; SAM-TR-73-52) Avail: NTIS CSCL 06/19

Recommendations, developed for the USAF School of Aerospace Medicine (SAM), concern a human psychomotor performance task which could be used to monitor, on a moment-to-moment basis, an operator's ability to perform satisfactorily during sustained acceleration stress. First, a survey was made of the literature on performance testing during G-stress, and/or on the relationship between physiologic and behavioral changes during acceleration. Next, an experimental program was planned and carried out, in which candidate tasks were evaluated under conditions of hypoxia and alcohol intoxication. Final recommendations were then made for: a running memory task to measure a decrement in cognitive skills; and an automated testing system, for installation on the SAM centrifuge, suitable not only for the recommended test but also for many other diversified tasks. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N75-11673# Sandia Labs., Albuquerque, N.Mex. Systems Studies Div.
MATHEMATICAL MODEL FOR DETERMINING THE PROBABILITY OF VISUAL ACQUISITION OF GROUND TARGETS BY OBSERVERS IN LOW-LEVEL HIGH-SPEED AIRCRAFT
W. H. Bradford Apr. 1974 22 p refs
(Contract AT(29-1)-789)
(SLA-74-141) Avail: NTIS HC $3.25

A cumulative distribution function for determining the probability of visually acquiring ground targets by observers in low-level high-speed aircraft was formulated as a function of range from target and a number of other parameters believed to have a major influence on target acquisition. Some illustrative calculations are included. Author (NSA)

N75-11674# School of Aerospace Medicine, Brooks AFB, Tex.
FB-3A CREW EVALUATION OF THERMOSTABILIZED BITE-SIZED MEATS Final Report, Jan. - Oct. 1973
Joseph C. Crigler, Donald M. Tucker, John E. Vanderveen, and John H. Hawk Jul. 1974 10 p refs
(AF Proj. 7930)
(AD-784810; SAM-TR-74-12) Avail: NTIS CSCL 06/8

Thermostabilized bite-sized meat items were evaluated under operational conditions by crewmemebers aboard FB-111A aircraft in missions of more than five hours. Food items were: roast beef, ham, and chicken. Results indicated that these bite-sized foods were highly acceptable to the crew, and were suitable for use in a comparatively small cockpit. A few evaluators requested more variety in, and heating of, food--and questioned the nutritional implications of the all-meat fare. Author (GRA)

N75-11675# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STATIC PROPENSITY OF VARIOUS AIR FORCE GARMENTS Final Report, May - Dec. 1973
Preston C. Opt and Jack H. Ross Jul. 1974 40 p refs
(AF Proj. 7320)
(AD-784789; AFML-TR-74-140) Avail: NTIS CSCL 11/5

The purpose of the tests described in this report was to measure the static propensity of a series of Air Force hospital, flignt and ground crew summer and winter garments fabricated of both currently available and experimental fabrics. The results are for assessing the hazards associated with the use of the various materials and materials combinations involved. The scope of the tests was limited to the measurement of static potential (voltage) after body movement, rubbing contact and separation of garments worn by test subjects. Tests were performed in an environmental chamber at 70F, 20-22% RH and 70F, 50-55% RH to demonstrate the role of humidity on static accumulation. All garments were new and tested in the as received condition. (Modified author abstract) GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N75-11676# Oak Ridge National Lab., Tenn.
INTERACTIVE MODELING OF ECOSYSTEMS
B. W. Rust and J. B. Mankin 1974 27 p refs Presented at Computer Simulation Conf., Houston, Tex., 9 Jul. 1974 Sponsored by AEC and NSF
(Conf-740703-1) Avail: NTIS HC $3.75

A computer program, MAIN, is presented which was developed to allow an ecologist with minimal experience in either mathematics or computers to develop an ecosystem model. The program provides the user with a flexible, interactive mode for solving simulation models. The program is written in FORTRAN for the DEC PDP-10 and can be modified for other terminal systems. As many as 100 parameters can be varied interactively by the user. An example illustrating the use of the program is included. NSA

N75-11677# California Univ., Livermore. Lawrence Livermore Lab.
SET OF DEVICE-INDEPENDENT FIRST LEVEL GRAPHICS ROUTINES
N. A. Storch 26 Apr. 1974 10 p refs Presented at 2d AEC Sci. Computer Inform. Exchange Meeting, New York, 2 May 1974 Sponsored by AEC
(UCRL-75578; Conf-740512-3) Avail: NTIS HC $3.25

A set of graphics routines (TV80) used as a language to plot points, lines and characters by FORTRAN applications programs is described. It is a device independent version of a set of routines long used at Lawrence Livermore Laboratory. Whereas the old routines were limited to one device, TV80 allows access to a number of devices through independent software processors. Features include scaling, clipping, scan conversion and character generation for raster devices, identification of output, handling of on-line display hardware, and generation of display commands. Author (NSA)

N75-11678# California Univ., Livermore. Lawrence Livermore Lab.
METRIC: A UNIT-CONVERSION PROGRAM FOR THE CDC 7600. PART 1: USING THE PROGRAM
D. Y. F. Lai 29 Mar. 1974 26 p refs
(Contract W-7405-eng-48)
(UCID-30090-Pt-1) Avail: NTIS HC $3.75

METRIC converts quantities expressed in one set of units into their equivalents in a second set of units. Basically, it is designed to convert quantities to the SI metric system, but the user can specify the second set of units if he chooses. Among METRIC's additional features are simplified repetitive conversion and provision for the user to define temporary units as intermediates in conversions. METRIC is available as an executable public file on the CDC 7600 computers in the Livermore time sharing system. Author (NSA)

N75-11679# Sandia Labs., Livermore, Calif. Numerical Applications Div.
CDC 6600 DATA MANAGER: A MULTI-DIMENSIONAL TABULATED FUNCTION MANAGER AND LINEAR INTERPOLATOR
J. Mansfield Apr. 1974 30 p
(Contract AT(29-1)-789)
(SLL-73-215) Avail: NTIS HC $3.75

The data manager package provides minimum field length storage allocation and organization for multi-dimensional tabulated functions and performs linear interpolation from them. Function entries are vectors of length one or more. There is no limit in theory to the maximum dimensionality, i.e., number of independent variables, of a table. Function storage may be allocated to extended core or central memory at the user's option. A choice of binary or linear searching algorithms is provided to minimize searching time during interpolation for discontinuous or continuous independent variables. Author (NSA)

N75-11680# California Univ., Livermore. Lawrence Livermore Lab.
BIBLIOGRAPHY ON COMPUTER OPERATING SYSTEM SECURITY
R. P. Abbott, L. M. Boone, I. M. Morvay, and S. Tokubo 15 Apr. 1974 199 p refs
(Contract W-7405-eng-48)
(UCRL-51555) Avail: NTIS HC $7.00

A bibliography of over 750 entries on the subject of computer security is presented, with particular emphasis on software and operating system security. The first of two parts is a KWOC (Key Word Out of Context) index that permits the rapid search of a computer generated list of key words based on an author/title file. The second part is a master list of each entry in order of accession number, and then listed with its corresponding author, title, publisher, and data of publication. Author

N75-11681# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
REGENT Semiannual Progress Report, Apr. - Oct. 1973
E. G. Schlechtendahl Jan. 1974 36 p refs In GERMAN; ENGLISH summary
(KFK-EXT-8-73-4; SAPR-4) Avail: AEC Depository Libraries HC $5.00

The project REGENT was started early 1972 by the Institut fuer Reaktorentwicklung. The fourth semiannual progress report summarizes the results achieved up to September 30, 1973, in particular with respect to the development of REGENT system nucleus. Details which have been documented in the references are not presented. The expected progress in the next half year period is listed. Author (NSA)

N75-11682# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF PULSE WIDTH MULTISTABLE ELEMENTS IN DIGITAL TECHNOLOGY
V. I. Khranak 17 Jun. 1974 13 p ref Transl. into ENGLISH from Mnogoustoichivye elementy i ikh primenenie, Sb. Statei (USSR), 1971 p 244-252
(AD-782853; FTD-MT-24-1019-74) Avail: NTIS CSCL 09/2

Pulse width multistable elements (ShIME), in which the steady states are distinguished by the length of square pulses and by fixed voltage levels, are examined with attention to their application to a wide series of tasks in automation and computer technology. The general principles of ShIME are discussed in terms of design problems for multifunctional scalers, registers, adders, and coding analog to digital converters. Author

N75-11009* Kanner (Leo) Associates, Redwood City, Calif.
DATA COMPRESSION
V. F. Babkin, A. B. Kryukov, and Yu. M. Shtarkov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 264-318 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 173-209 (For availability see N75-10988 02-18)
CSCL 09B

N75-11013* Kanner (Leo) Associates, Redwood City, Calif.
POTENTIAL CAPABILITIES FOR COMPRESSION OF INFORMATION OF CERTAIN DATA PROCESSING SYSTEMS
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 353-367 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 353-367 (For availability see N75-10988 02-18)
CSCL 09B

N75-11014* Kanner (Leo) Associates, Redwood City, Calif.
STATISTICAL ANALYSIS OF INFORMATION FROM LONG-RANGE SPACECRAFT
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 368-378 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 239-245 (For availability see N75-10988 02-18)
CSCL 09B

N75-11015* Kanner (Leo) Associates, Redwood City, Calif.
A PRIORI ESTIMATE OF THE QUALITY OF A DATA COMPRESSION SYSTEM BASED ON STATISTICAL CHARACTERISTICS OF THE SENSORS USED
Yu. K. Khodarev, V. P. Yevdokimov, and V. M. Pokras *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 379-386 ref Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 246-250 (For availability see N75-10988 02-18)
CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N75-11683# Knolls Atomic Power Lab., Schenectady, N.Y.
GRAIL: A GRAPHICAL DEVICE-INDEPENDENT PICTURE DESCRIPTION SYSTEM
J. A. Brooking 8 Feb. 1974 47 p refs
(Contract W-31-109-eng-52)
(KAPL-P-4012) Avail: NTIS HC $3.75

GRAIL is a collective term which is used to define the graphical data structure, machine-oriented conventions for describing pictures, the subroutines which implement these conventions, and the post-processor programs which transform GRAIL picture description files into device-dependent picture description files. The conventions used to describe pictures in GRAIL, and the ways these conventions contribute to realizing GRAIL design objectives are discussed. Author

N75-11684# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
MICROPROGRAMMING AND ITS RELATIONSHIP TO EMULATION AND TECHNOLOGY
Samuel H. Fuller, Victor R. Lesser, C. Gordon Bell, and Charles Kaman May 1974 25 p refs Presented at the 7th Ann. Microprogramming Workshop, Palo Alto, Calif., 1 Oct. 1974 Prepared in cooperation with Digital Equipment Corp., Maynard, Mass.
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-784822; AFOSR-74-1428TR) Avail: NTIS CSCL 09/2

The structure of microprogrammed processors, and microprogramming in general, is largely determined by two facts: the state of (semiconductor) technology and the task of emulation. This article first reviews those technological advances as well as those constraints and demands imposed by the emulation process that have shaped the evolution of microprogramming. The other main theme of this article is that it is a fruitless exercise to try to characterize and understand microprogramming in terms of how it differs from regular programming. The right approach to understanding microprogramming is to recognize that it is primarily applied to the task of emulation (interpretation). Through this approach the evolution of microprogramming independent of a particular technology and type of instruction set being emulated is reviewed and future trends are indicated.
Author (GRA)

N75-11685# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EIGENVALUE PROPERTIES OF PROJECTION OPERATORS AND THEIR APPLICATION TO THE SUBSPACE METHOD OF FEATURE EXTRACTION
Charles W. Therrien 15 Aug. 1974 23 p refs
(Contract F19628-73-C-0002; DA Proj. 7X2-63304-D-215)
(AD-784863; TN-1974-41; ESD-TR-74-242) Avail: NTIS CSCL 09/2

The subspace method proposed by Watanabe, et al. is an important method of feature extraction in pattern recognition. Some new results described here provide a formulation of the subspace method that is particularly easy to implement and overcomes the various numerical difficulties that were inherent in earlier implementations of the method. The present formulation is also important in that it provides the key to the relation of this method to other methods of feature extraction.
Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N75-11686# Argonne National Lab., Ill.
USAEC COMPUTER PROGRAM SUMMARIES: NUMBERS 55 THROUGH 123
Apr. 1974 68 p
(Contract W-31-109-eng-38)
(ANL-8040-Supp-1) Avail: NTIS HC $4.25

In 1972 the scope of activities of the Argonne Code Center was officially expanded to include computer programs developed in all of the U. S. Atomic Energy Commission program areas. The Computer Program Summary report contains summaries of computer programs at the specification stage, under development, being checked out, in use, or available at Commission offices, laboratories, and contractor installations. The purpose of the report is keep the USAEC, AEC-laboratory, and contractor personnel informed as to the existence, status, and availability of computer programs within the agency. The following information is provided for each program: author/contact, category, program identification and Key-Word-In-Context title, contractor, funding division, status, computer, programming language(s), program size, summary, references, availability, and distribution. Appendixes to this report contain the programs by subject category and a KWIC index. NSA

N75-11687# Instituto de Energia Atomica, Sao Paulo (Brazil).
PROGRAM IN BASIC LANGUAGE FOR ANALYSIS OF GAMMA SPECTRA, USING ON-LINE MINICOMPUTERS
F. W. Lima and L. T. Atalla Nov. 1973 15 p refs
(IEA-317) Avail: AEC Depository Libraries HC $4.00

A program in Instrument Basic language is proposed for analysis of gamma spectra obtained with Ge-Li detectors and accumulated multichannel analyzers on-line with minicomputers. The program locates the peaks, evaluates the corresponding energy values, the net peak areas, and the standard deviation of the areas. Author (NSA)

N75-11688# European Atomic Energy Community, Geel (Belgium). Central Bureau for Nuclear Measurements.
CBNM SATELLITE COMPUTER SYSTEM. PART 1: THE MULTIPARAMETER SYSTEM USER HANDBOOK
F. Colling Apr. 1974 66 p refs
(EUR-5113) Avail: AEC Depository Libraries HC $6.50

The main features of the CBNM satellite computer multiparameter system are described whereby specical consideration is given to the user. The satellite computer (GA 18/30,24K) has a fast link (160K BAUD) to the central computer (IBM 1800, 64K). Five basic data acquisition reduction and storage programs for single and multiparameter experiments for up to four simultaneous uweers are presented. The on-line system is able to provide multichannel analyzer functions for up to 128K channels in a 16K memory area. Only a reduced count capacity is provided per channel and an intrinsic system of dynamically allocatable overflow zones allows the low count capacity to be extended locally. When the overflow capacity of the system is exhausted, the sorted data are transferred to the disk of the central computer, the transferred zones erased and the measurement continued. In this way only about 1% of the central real time processing power is used. The numerous possibilities of the off-line system including up to 30 different routines are described. All routines can be called by a two-letter code. The OFF-LINE system is almost completely stored on the disk of the central computer and parts of the system are loaded automatically in an overlay area when needed by the user. Author

N75-11689# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 1: DEVELOPMENT OF MACROMODULES. VOLUME 3: DESIGN OF PHASE 1 MACROMODULES Final Report, 1 Apr. 1965 - 1 Dec. 1973
Christine D. Coaker Feb. 1974 198 p refs
(Contract ARPA SD-302; Grant RR-00396)
(AD-783873; TR-46) Avail: NTIS CSCL 09/2

The volume attempts to reconstruct the rationale for the

major design decisions that were made in the development of Phase One macromodules, and presents a review of the internal architecture, intercommunication, electrical and mechanical design. Material describing the interfacing of macromodular systems to other computers is also included. The level of detail presented is intermediate, and assumes a general familiarity with the concept of macromodules and their usage. (Modified author abstract) GRA

N75-11690# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 1: DEVELOPMENT OF MACROMODULES. VOLUME 4: THE SYNCHRONIZER GLITCH PROBLEM Final Report, 1 Apr. 1965 - 1 Dec. 1973
Thomas J. Chaney Feb. 1974 60 p refs
(Contract ARPA SD-302; Grant RR-00396)
(AD-783874; TR-47) Avail: NTIS CSCL 09/2

There is a fundamental problem in synchronizing communication between any two concurrently operating digital systems that lack a common time reference. This problem involves the inability to build a completely reliable synchronizer or arbiter that will work in a prescribed amount of time. Stimulated by the need for an interlock macromodule design of predictable reliability, the inability to find evidence of previous studies, and indications that this problem has been responsible for significant reduction in the reliability of several commercial machines, the author undertook theoretical and experimental studies of this problem. The results to date of these studies are documented in the volume. Author (GRA)

N75-11691# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 1: DEVELOPMENT OF MACROMODULES. VOLUME 5: LABORATORY PERSONNEL AND BIBLIOGRAPHY Final Report, 1 Apr. 1965 - 1 Dec. 1973
Christine D. Coaker Feb. 1974 75 p refs
(Contract ARPA SD-302; Grant RR-00396)
(AD-783875; TR-48) Avail: NTIS CSCL 09/2

The volume gives names and titles of all personnel associated with the Macromodular Computer Design project. Titles, authors, dates and abstracts of relevant technical reports and Technical Memoranda originating during this period are given, as well as a bibliography of related Washington University theses and dissertations and of publications in the open literature. (Modified author abstract) GRA

N75-11692# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 6: PRINTED CIRCUIT BOARD OUTLINES AND ELECTRONIC PACKAGING MECHANICAL DRAWINGS Final Report, 1 Apr. 1965 - 31 Dec. 1973
Robert J. Arnzen Feb. 1974 83 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783881; TR-35) Avail: NTIS CSCL 09/2

Complete mechanical drawings regarding the manufacture of components and assembly specifications for the macromodular electronic cases and printed circuit board routing dimensions for macromodular electronic assemblies are given. Author (GRA)

N75-11693# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 7: FACEPLATE SPECIFICATIONS Final Report, 1 Apr. 1965 - 31 Dec. 1973
Gerald C. Johns Feb. 1974 86 p
(Contract ARPA SD-302; RR-00396)
(AD-783882; TR-36) Avail: NTIS CSCL 09/2

Specifications for the construction of Macromodular Faceplate Box assemblies are contained in the report. Also included are all electrical and mechanical specifications for common subassemblies. Certain general assembly techniques are specified. Author (GRA)

N75-11694# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 8: FACEPLATE OVERLAYS, OVERLAY LABELS AND FACEPLATE BOXES, TYPES 1-4 Final Report, 1 Apr. 1965 - 31 Dec. 1973
George L. Bickmore Feb. 1974 94 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783883; TR-37) Avail: NTIS CSCL 09/2

The document is divided into two segments. The first segment, pages 100.1-1 through 100.1-5, contains the information necessary to duplicate Macro-module Faceplate Overlays and Overlay Labels plus a brief functional description of the Overlay. The second segment of this volume contains the necessary procedures and wiring lists for the assembly of Macro-Module Faceplate Box types 1 through 4. Author (GRA)

N75-11695# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 9: FACEPLATE BOXES, TYPES 5-10 Final Report, 1 Apr. 1965 - 31 Dec. 1973
George L. Bickmore Feb. 1974 93 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783884; TR-38) Avail: NTIS CSCL 09/2

The document contains the necessary procedures and wiring lists for the assembly of Macro-Module Faceplate Box types 5 through 10. Author (GRA)

N75-11696# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 10: PARAMETER SWITCHES, MINI CONSOLE, AND L. E. D. DATA INDICATOR Final Report, 1 Apr. 1965 - 31 Dec. 1973
Feb. 1974 99 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783885; TR-39) Avail: NTIS CSCL 09/2

The assembly procedures for the Parameter Switch, Mini Console, and LED Data Indicator is given here along with the parts lists and description of special tools required for proper assembly. Author (GRA)

N75-11697# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 11: CABLES Final Report, 1 Apr. 1965 - 31 Dec. 1973
Gerald C. Johns Feb. 1974 80 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783886; TR-40) Avail: NTIS CSCL 09/2

Manufacturing information for the construction and testing of macromodular cables is given. Included are the data cable, control cable, pedestal daisy chain cable, and function caller cable. Author (GRA)

N75-11698# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 13: FRAME SECTION AND BASE PEDESTAL Final Report, 1 Apr. 1965 - 31 Dec. 1973
Robert J. Arnzen Feb. 1974 120 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783888; TR-42) Avail: NTIS CSCL 09/2

A complete description of mechanical and electrical components, assembly specifications, and procedures for manufacture of the macromodular frame block and base-pedestal comprises the report. Author (GRA)

N75-11699# Washington Univ., St. Louis, Mo. Computer Systems Lab.
MACROMODULAR COMPUTER DESIGN. PART 2: MANUFACTURING DESCRIPTION. VOLUME 14: PEDESTAL CONTROLLER, FAN MODULE, CHANNEL COUPLER AND JIGS Final Report, 1 Apr. 1965 - 31 Dec. 1973

Robert J. Arnzen Feb. 1974 116 p
(Contract ARPA SD-302; Grant RR-00396)
(AD-783889; TR-43) Avail: NTIS CSCL 09/2

A complete description of electrical and mechanical components, assembly jigs and procedures for manufacture of the macromodular base-pedestal controller, fan module and channel coupler is given. Author (GRA)

N75-11700# University of Southern Calif., Marina del Rey. Information Sciences Inst.
A RESEARCH PROGRAM IN THE FIELD OF COMPUTER TECHNOLOGY Annual Technical Report, 17 May 1973 - 16 May 1974
Keith W. Uncapher May 1974 135 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-784135; ISI/SR-74-2) Avail: NTIS CSCL 09/2

This report summarizes the research performed by USC/Information Sciences Institute from 17 May 1973 to 16 May 1974. The research is aimed at applying computer science and technology to problem areas of high DoD/military impact. The ISI program consists of ten research areas: Automatic programming; program verification; programming research instrument; protection analysis; command and control message technology; information automation; network secure speech; technology support; network management information center; research resources. GRA

N75-10996* Kanner (Leo) Associates, Redwood City, Calif.
COMPUTERS AND PROSPECTS FOR AN ON-BOARD SPACECRAFT ELECTRONIC EQUIPMENT
V. V. Andreyanov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 88-96 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 58-63 (For availability see N75-10988 02-18)
CSCL 09B

N75-11799 Joint Publications Research Service, Arlington, Va.
CSAV COMPUTER TECHNOLOGY CHAIRMAN DISCUSSES PROGRESS IN THE FIELD
Zdenek Volny and Alexej Verner *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 12-16 Transl. into ENGLISH from Tvorba (Prague), no. 39, 25 Sep. 1974 p 15 (For availability see N75-11796 02-81)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N75-11701# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
HILBERT INFORMATION FEATURES AND THEIR APPLICATION FOR PATTERN RECOGNITION
L. M. Soroko and T. A. Strizh 1974 20 p refs In RUSSIAN (JINR-P10-7569) Avail: AEC Depository Libraries HC $4.00

The Hilbert information features are introduced. Use of these features together with the Fourier information features increases the dimensionality of feature space formed by the optical cascades at the coherent lighting from 3 to 8. The values of the reference vector components for the information features in the six dimensional space are presented for several letters of the Roman alphabet. Author (NSA)

N75-11702# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CONTROL THEORY Final Scientific Report, 1 Mar. 1972 - 28 Feb. 1974
J. E. Ackermann and R. K. Sharma Aug. 1974 57 p refs
(Grant AF-AFOSR-2463-73; AF Proj. 9767)
(AD-784935; DFVLR-IB-74/13; EOARD-TR-75-7) Avail: NTIS CSCL 12/1

The R and D activities at the Institute for Flight Dynamics of the DFVLR spanned mathematical modelling (Minimal realization and identification), deterministic synthesis of multivariable control systems, stochastic filtering and control, control and tracking problems of antennas, and satellite attitude estimation and control. The final scientific report contains fifteen papers on specific problems and applications of these topics conducted during the period of the grant. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N75-11703# Joint Publications Research Service, Arlington, Va.
METHODS AND APPARATUS FOR ANALYZING THE CHARACTERISTICS OF RANDOM PROCESSES
A. F. Kotyuk, V. V. Olshevskiy, and E. I. Tsvetkov 1 Nov. 1974 109 p refs Transl. into ENGLISH from the book "Metody i Apparatura Analiza Kharakteristik Sluchaynykh Protsessov" Moscow, Izd. Energiya, 1967
(JPRS-63343) Avail: NTIS HC $5.25

Data are reported on correlation and spectrum analysis of random processes, multipurpose statistical analyzers based on elements and devices of analog and discrete computer equipment, and on instrument analysis and extracting information from useful signals. Author

N75-11704# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
SOLUTION OF PROBLEMS WITH INTERFACES AND SINGULARITIES
I. Babuska Apr. 1974 75 p refs
(Contract AT(40-1)-3443)
(ORO-3443-48; BN-789) Avail: NTIS HC $4.25

Applications of the finite element method deal with the question of how to handle the singularities of the solution arising especially because of interfaces and unsmoothness of the domain. Global and local problems are investigated and include power reactor problems, problems of composite materials, biological studies related to the flow of electrical current in the brain, the diffusion of metabolics in the tissues, mechanics of fracture, and others. NSA

N75-11705# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
SOLUTION OF THE INTERFACE PROBLEM BY HOMOGENIZATION, PART 2
I. Babuska Mar. 1974 33 p ref
(Contract AT(40-1)-3443)
(ORO-3443-47-Pt-2; BN-787-Pt-2) Avail: NTIS HC $3.75

The homogenization problem is studied for the general second order differential equations. It is shown that the homogenized form yields the same differential operator relating to second derivatives as in the limited analysis. F.O.S.

N75-11706# Sandia Labs., Albuquerque, N.Mex. Numerical Applications Div.
TJMAR1: FORTRAN SUBROUTINE FOR NONLINEAR LEAST SQUARES PARAMETER ESTIMATION
T. H. Jefferson Mar. 1974 29 p refs
(Contract AT(29-1)-789)
(SLL-73-305) Avail: NTIS HC $3.75

TJMAR1 is a CDC 6600 FORTRAN subroutine designed for nonlinear least squares parameter estimation. The principal applications of the routine are in data fitting and in solving systems of simultaneous algebraic equations. This document is a user's manual for TJMAR1 and contains a description of the mathematical method employed, an explanation of the calling sequence, and examples of use. Author (NSA)

N75-11707# Washington Univ., St. Louis, Mo. Dept. of Computer Science.
BINOMIAL CONVOLUTION PRESERVES LOG-CONCAVITY
David W. Walkup Jul. 1974 8 p refs
(Contract N00014-67-A-0445)
(AD-783088; CS-74-7) Avail: NTIS CSCL 12/1

A sequence f = (f0,f1,...) of nonnegative numbers is

log-concave if ln fi is a concave function of i. If two sequences f and g are both log-concave, then so is their binomial convolution. This complements the similar well-known result for ordinary convolution. (Modified author abstract) GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N75-11708# Texas A&M Univ., College Station. Inst. of Statistics.
SIMULATION WITH STATISTICAL CONTROL VARIABLES
D. M. Scott, William B. Smith, and H. O. Hartley Jun. 1974 26 p refs
(Contract DAHC04-74-C-0018)
(AD-783420; TR-12; AROD-8049-11-M) Avail: NTIS CSCL 14/4

An improved procedure for estimating system reliability is developed, combining numerical integration and statistical simulation. The procedure uses stratified numerical approximation followed by a post-stratification sample for control variable purposes. This combination results in accuracies comparable to that of stratified Monte Carlo simulation at less computational costs. Author (GRA)

N75-11709# California Univ., Los Angeles. Dept. of System Sciences.
ON A CLASS OF STOCHASTIC BANG-BANG CONTINUOUS TIME CONTROL PROBLEMS Ph.D. Thesis. Interim Report
Jiri Ruzicka 1974 108 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-783258; AFOSR-74-1285TR) Avail: NTIS CSCL 12/1

The report deals with the optimal control of a class of stochastic, continuous time system with noisy observations on a finite time interval. The evolution of the state of the system as well as the observation process are described by linear stochastic differential equations. The optimal control process is required to be bounded in magnitude and to depend only on the data available, the optimality being taken in the mean square sense. The control constraints make the overall problem nonlinear. In addition to existence as well as necessary and/or sufficient conditions for optimality, the author obtains an explicit characterization of the optimal control; it is shown that the optimal control is of bang-bang type and is a function of the Kalman estimate of the state. (Modified author abstract) GRA

N75-11710# Stanford Univ., Calif. Dept. of Operations Research.
COMPUTATION OF THE RELIABILITY OF A STOCHASTIC NETWORK
Andrew W. Shogan 29 Apr. 1974 91 p refs
(Contract N00014-67-A-0112-0052; NR Proj. 042-002)
(AD-783012; TR-161) Avail: NTIS CSCL 14/4

Given a directed network whose arcs either function or fail with known probabilities, define the reliability of a node as the probability that there exists a path from the network's source to the node composed only of functioning arcs. An algorithm is presented that recursively computes the reliabilities of nodes of the network until the reliability of the sink is obtained. Furthermore, algorithms are presented to recursively bound the reliabilities of nodes until upper and lower bounds on the reliability of the sink are obtained. These bounds are shown analytically to be tighter than the existing Esary-Proschan bounds. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N75-11711# Naval Research Lab., Washington, D.C.
SADDLEPOINT OPTIMALITY IN DIFFERENTIAL GAMES Interim Report
H. L. Stalford and G. Leitmann 22 Jul. 1974 15 p refs
(NRL Proj. B01-15; RR0140201)
(AD-784407; NRL-7766) Avail: NTIS CSCL 12/2

A family of two-person zero-sum differential games in which the admissible strategies are Borel measurable is defined, and two types of saddlepoint conditions are introduced as optimality criteria. In one, saddlepoint candidates are compared at each point of the state space with all playable pairs at that point; in the other, they are compared only with strategy pairs playable on the entire state space. As a theorem, these two types of optimality are shown to be equivalent for the defined family of games. Also, it is shown that a certain closure property is sufficient for this equivalence. A game having admissible strategies everywhere constant in which the two types of saddlepoint candidates are not equivalent is discussed. Author (GRA)

N75-11712# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE ANALYSIS OF LINEAR NONSTEADY-STATE SYSTEMS BY THE INTEGRAL TRANSFORMS METHOD
V. L. Lebedev 27 Jun. 1974 7 p Transl. into ENGLISH from Prikl. Mat. i Kibernetika (Moscow), 1973 p 20-21
(AD-782851; FTD-HT-23-2061-74) Avail: NTIS CSCL 12/1

Certain integral transforms which are generalizations of the Laplace transforms, are considered in order to explain which kernels correspond to what concrete forms of equations, i.e., which integral transforms can be applied to what nonsteady-state systems. The examples show that the expanding area of integral transforms discloses certain recent suggestions for the study of linear nonsteady-state systems. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N75-11713# Pennsylvania Univ., Philadelphia. Dept. of Physics.
RECENT RESEARCH, RESEARCH IN PROGRESS AND PLANS FOR EXPERIMENTAL AND THEORETICAL RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS, NUCLEAR PHYSICS AND ASTROPHYSICS. VOLUME 2: ELEMENTARY PARTICLE, ASTRO-PHYSICS, NUCLEAR PHYSICS Progress Report
Apr. 1974 49 p refs
(Contract AT(11-1)-3071)
(COO-3071-81) Avail: NTIS HC $3.75

This report consists of sections describing research, written by each physicist. The more significant items include the observation of neutrino-induced events without the production of muons, a study of inclusive deep inelastic scattering of hadrons, progress in the fabrication of the MPS facility, and observation of very large and intriguingly spaced signals in an underground neutrino detector. The descriptions of the research are quite general and present data only incidentally. A list of publications is included. NSA

N75-11714# National Inst. for Metallurgy, Johannesburg (South Africa).
DETERMINATION OF LINE INTENSITIES IN THE PRESENCE OF INTERFERING SPECTRA IN DISPERSIVE X-RAY-FLUORESCENCE SPECTROMETRY Project Report No. 2
C. E. Austen 25 Jan. 1974 23 p refs
(NIM-1592) Avail: AEC Depository Libraries HC $4.25

Two techniques are described for the determination of the

net intensity of an X-ray peak when the background under the peak cannot be accurately evaluated owing to the presence of adjacent spectra. For the first technique the intensity distribution of an X-ray peak that is free interference is represented by a series of straight line equations. Two background intensities free from interference, and the gross peak intensities of the analytical line and of the interfering spectra are substituted into simultaneous equations, which are then solved. The second technique involves the measurement of the gross peak intensity of the analytical line and the intensities of two points, one on each sloping side of the analytical peak. These intensity data are then substituted into a simple equation. These two techniques have been successfully applied to the quantitative determination of tantalum and niobium in ores on a routine basis. Author (NSA)

N75-11715# Sandia Labs., Albuquerque, N.Mex.
THEORY AND PRACTICE OF MEASURING MASS PROPERTIES
G. R. Norris, Jr. Apr. 1974 23 p refs Supersedes SC-TM-67-2945
(Contract AT(29-1)-789)
(SLA-74-127; SC-TM-67-2945) Avail: NTIS HC $3.25

Basic parameters and methods of measuring mass properties are discussed. Some of the equipment used at Sandia is briefly described along with its expected accuracy. The addition of a digital computer has greatly improved the efficiency of mass properties determinations; SI units have been added for comparison. Author

N75-11716# California Univ., Berkeley. Lawrence Berkeley Lab.
MASS TRANSFER TO A PLANE BELOW A ROTATING DISK Ph.D. Thesis
R. V. Homsy Mar. 1974 164 p refs
(Contract W-7405-eng-48)
(LBL-2291) HC $5.25

Mass transfer to a stationary disk imbedded in a plane below a rotating disk was studied both theoretically and experimentally. For a disk of uniform surface concentration, a diffusion-layer solution was found which breaks down in two regions (one at the center and one at the leading edge of the mass-transfer section). The mass-transfer rate was solved in these regions; near the center it is the same as was found in the rear region of an axisymmetric bluff object in Stokes flow. It was found that when the system is treated as an electrochemical system, the current distribution on the electrode becomes more nonuniform as the limiting current is approached. An experiment is reported in which the local mass-transfer rated was measured using electrodeposition of copper at the limiting current. The deposit thickness profile shows good agreement with predicted theoretics. The mass-transfer rate at the center of the electrode is higher than was expected, owing to natural convection or misalignment of the rotating disk above the plane. Author

N75-11717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROPAGATION OF WAVES IN A PHYSICALLY NONLINEAR MEDIUM WEAKENED BY A CYLINDRICAL OR SPHERICAL CAVITY
P. F. Sabodash and I. A. Tsurpal 2 Aug. 1974 20 p refs Transl. into ENGLISH from Rasprostranenie Uprugikh i Uprugoplast. Voln, 3d (Moscow), 1969 p 149-162
(AD-784720; FTD-MT-24-1865-74) Avail: NTIS CSCL 20/12

Differential equations of the propagation of cylindrical waves are obtained taking into account the change of volume and form in a nonlinear elastic medium. The fundamental equations for compressible and incompressible materials are found, taking into account small physical nonlinearity. The fundamental equations of the propagation of spherical waves in a nonlinear elastic medium are determined for small physical nonlinearity, which is characterized by the square of deformation intensity. GRA

N75-11718# Army Foreign Science and Technology Center, Charlottesville, Va.
INFRARED RADIATION RECEIVERS
M. N. Markov 4 Apr. 1974 233 p refs Transl. into ENGLISH from the book "Preimnika Infrakrasnogo Izlucheniya" Moscow, 1968 168 p
(AD-784804; FSTC-HT-23-1889-73) Avail: NTIS CSCL 17/5

The physical principles and designs of contemporary thermal and photoelectric IR detectors are reviewed. Their parameters are discussed, including various forms of noise, conversion ratio, time constant, threshold sensitivity, detecting ability. The effects of cooling are discussed and comparison of various detector types is made. Certain applications are reviewed. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N75-11719# California Univ., Livermore. Lawrence Livermore Lab.
COLLECTION OF ULTRASONIC VELOCITY DATA AS A FUNCTION OF PRESSURE FOR POLYCRYSTALLINE SOLIDS
R. N. Schock, B. P. Bonner, and H. Louis 10 Apr. 1974 262 p refs
(Contract W-7405-eng-48)
(UCRL-51508) Avail: NTIS HC $8.50

The measurement of ultrasonic velocity in polycrystalline solids at atmospheric pressure is discussed along with the effects of stress on measurement accuracy. Measurement data are given in tabular form. E.H.W.

N75-11720# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
ACOUSTIC MULTISTRIP DEVICE TECHNIQUES Semiannual Report, 1 Jul. 1973 - 28 Feb. 1974
T. W. Bristol and C. W. Chapman Aug. 1974 54 p refs
(Contract DAAB07-73-C-0276; DA Proj. 1A6-62705-A-057)
(AD-784241; FR-74-14-564; ECOM-73-0276) Avail: NTIS CSCL 09/1

The report describes the accomplishments of the first six months of development of optimum techniques for the analysis and design of multistrip devices. A field theory approach was used to analyze the performance of the symmetrical multistrip coupler (MSC). The theory and its experimental verification are described and extensions of the approach for analysis of more general multistrip devices are summarized. Author (GRA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N75-11721# Joint Publications Research Service, Arlington, Va.
OPERATIONS WITH THE BETA-S AND PINGVIN THERMOELECTRIC ISOTOPE GENERATORS IN THE ANTARTIC
Ye. P. Kharin 22 Oct. 1974 10 p refs Transl. into ENGLISH from Inform. Byull. Sov. Antarkt. Eksped. (Leningrad), no. 88, 1974 p 62-67
(JPRS-63259) Avail: NTIS HC $3.25

The use of the 'Pingvin' and 'Beta-S' thermoelectric isotope generators in the Antarctic is described, with a discussion of their performance reliability. Author

N75-11722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROTONS AS THE PRIME CONTRIBUTORS TO THE STORM TIME RING CURRENT
F. W. Berko, L. J. Cahill, Jr. (Minn. Univ., Minneapolis), and T. A. Fritz (NOAA, Boulder, Colo.) Oct. 1974 19 p refs Submitted for publication
(NASA-TM-X-70779; X-626-74-305) Avail: NTIS HC $3.25 CSCL 20H

Following a large magnetic storm (17 June 1972), Explorer 45 measured the equatorial particle populations and

magnetic field. Using data obtained during the symmetic recovery phase, it is shown that through a series of self-consisent calculations, the measured protons with energies from 1 to 872 keV, can account for the observed ring current magnetic effects within experimental uncertainities. This enables an upper limit to be set for the heavy ion contribution to the storm time ring current. Author

N75-11723# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
HYDROGEN PRODUCTION FROM WATER BY REACTOR HEAT
S. Dorner Feb. 1974 46 p refs In GERMAN; ENGLISH summary
(KFK-1915) Avail: AEC Depository Libraries HC $5.50

The already proposed or known procedures of obtaining hydrogen by means of reactor heat are discussed. The critical review shows that so far an adequate procedure cannot be proposed; therefore, we attempted to indicate novel processing means using an extended process systematics. New working hypotheses can be established on the basis of this process systematics. Author (NSA)

N75-11724# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MAGNETIC BUBBLE MATERIAL RADIATION HARDNESS STUDY
Lester F. Lowe, Clarence D. Turner, and John R. Hyatt 12 Jul. 1974 13 p refs
(AF Proj. 5621)
(AD-784792; AFCRL-PMSRP-597; AFCRL-TR-74-0316) Avail: NTIS CSCL 20/12

Several magnetic bubble material samples were exposed to fission neutrons and Co-60 gamma rays in order to assess their radiation sensitivity. Magnetic property measurements were made before and after irradiation. No changes in magnetic properties were observed in any sample up to 4 x to the 14th power n/sq cm and 10 to the 8th power to 10 to the 9th power Rad(Si) Co-60. Table 1 summarizes the results and also gives other results on other samples which were irradiated at AFCRL and evaluated elsewhere. The in-house measurements consisted of coercivity, magnetization, wall energy, and characteristic length. Appendix A gives a detailed data analysis of the inhouse experimental results on three samples. The remainder of this report consists of a brief summary of the experimental measurements made at AFCRL and also the details of the radiation exposures. GRA

N75-11725# Army Foreign Science and Technology Center, Charlottesville, Va.
IONIC ACTIVITY IN MOLTEN SALTS
M. V. Smirnov, V. N. Chebotin, V. E. Komarov, Yu. V. Nasonov, and A. P. Khaemenov Dec. 1973 21 p refs Transl. into ENGLISH from Tr. Inst. Elektrokhim. Akad. Nauk SSSR, Ural. Filial (USSR), no. 16, 1970 p 3-16
(AD-784171; FSTC-HT-23-1338-73) Avail: NTIS CSCL 07/4

On the basis of a complex model proposed earlier for the structure of molten salts, ionic activity was calculated in a molten mixture containing several kinds of ions. Systems with the same anion and two or three types of cations were considered in detail. It was shown that the systems do not behave ideally if the cations differ noticeably in their capacity to form complexes. On the basis of the formulas obtained for the ionic activity, the equilibrium potentials of the metallic and chlorine electrodes were calculated for several galvanic elements with molten salt electrolytes under the assumption that there was no diffusion potential in the diaphragm. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N75-11726# Nihon Univ., Tokyo (Japan). Dept. of Physics.
AN EXAMPLE OF INFINITE-COMPONENT WAVE EQUATION WITHOUT SPACE-LIKE SOLUTION
Osamu Hara and Shigefumi Naka (Tokyo Univ.) [1974] 7 p ref
(NUP-A-74-14) Avail: NTIS HC $3.25

An infinite-component wave equation without a space-like solution is proposed. Starting with the assumption that the system carries an internal motion, which is described by a two-component spinor, it is shown that the equation can be considered as a Hamiltonian for a simple harmonic oscillator. It is concluded the antiparticles are described without resort to the hole theory. F.O.S.

N75-11727*# Oak Ridge National Lab., Tenn.
CONTINUATION OF DEVELOPMENT OF NITRIDES FOR SPACE NUCLEAR REACTORS Final Report
R. A. Potter and J. L. Scott Mar. 1974 21 p refs Sponsored in part by AEC
(NASA Order C-16968-C)
(NASA-CR-134498; ORNL-TM-4496) Avail: NTIS HC $3.25 CSCL 18E

Alloy nitrides (U,Zr), (U,Ce), and (U,Y) were prepared and exposed to vacuum at temperatures to 1700 C (1973 K) and compared with pure UN. Weight loss data and physical observations showed that the alloy samples were more stable than UN. In weight loss, (U,Zr)N was 3 times as stable as UN at 1600 C (1873 K) for 100 hr at 0.000002 torr (0.000266n/sq.m.). Author

N75-11728# Oak Ridge National Lab., Tenn.
SOCIAL EFFECTS OF NUCLEAR POWER PLANTS
E. Peelle 1974 9 p refs Presented at the 5th Ann. Meeting of the Environ. Design Res. Assoc., Milwaukee, 30 May 1974 Sponsored by AEC
(Conf-740520-1) Avail: NTIS HC $3.25

Assessment of impacts involves dimensioning with fourteen descriptors, and analysis of impact recipient groups. Social impact alternatives are listed as are requirements for adequate social impact analysis. Author (NSA)

N75-11729# Atomic Energy Commission, Washington, D.C.
LIQUID METAL FAST BREEDER REACTOR PROGRAM. VOLUME 4. ALTERNATIVE TECHNOLOGY OPTIONS. ENVIRONMENTAL STATEMENT
Mar. 1974 751 p refs
(WASH-1535-Vol-4) Avail: NTIS HC $17.25

Alternate energy options including other means of exploiting nuclear energy, nonnuclear energy sources, more efficient means of converting energy resources to useful forms, and more conservative means of using the available energy are evaluated. Fast nuclear reactors, controlled thermonuclear reactors, fossil fuels for central station electrical generation, hydroelectric power systems, geothermal energy, and solar energy are described. Improved energy conversion, storage devices, conservation of energy, and the utilization of energy are discussed. NSA

N75-11730# Brookhaven National Lab., Upton, N.Y.
APPLICATIONS OF FUSION POWER TECHNOLOGY TO THE CHEMICAL INDUSTRY
M. Beller, J. R. Powell, and M. Steinberg 2 Jun. 1974 40 p refs Presented at the 77th Natl. Meeting on the Am. Inst. of Chem. Engr., Pittsburgh, 2 Jun. 1974 Sponsored by AEC
(BNL-18815; Conf-740609-2) Avail: NTIS HC $3.75

Energy forms available from controlled thermonuclear reactors (CTR) are reviewed, and methods of application to chemical processes are discussed. Specific chemical processes which can utilize CTR energy are described, and the potential for this utilization is assessed. Author (NSA)

N75-11731# Sandia Labs., Albuquerque, N.Mex.
THERMONUCLEAR REACTIONS IN SOLID SPHERICAL LASER TARGETS
M. J. Clauser 22 Apr. 1974 20 p refs Presented at the 7th European Conf. on Plasma Production by High Power Laser targets, Garching, West Germany, 22 Apr. 1974 Sponsored by AEC
(SLA-74-5252; Conf-740439-1) Avail: NTIS HC $3.25

The behavior of spherical targets irradiated by simple unshaped laser pulses was investigated. It was found that the neutron production is strongly dependent on the sphere diameter and the laser pulse length, as well as the absorbed energy. In the spherical targets the dominant mechanisms for ion heating are compression by a spherically converging shock wave and subsonic compression caused by the high electron pressure in the outer portion of the sphere, as well as by equilibration with hot electrons. For fixed sphere diameter and laser pulse length one finds that the neutron production can increase as rapidly as the fifth power of the absorbed energy. However, these curves inevitably level off and start decreasing as the energy is increased further. The optimum sphere diameter and the optimum pulse length are both weakly dependent on the amount of absorbed laser energy. At these optimum values the neutron production varies approximately as the 1.6 power of the absorbed energy. NSA

N75-11732# Danish Atomic Energy Commission, Risoe.
SWELLING RESISTANCE INDUCED BY GRAIN REFINEMENT AND PARTICLE DISPERSION IN AUSTENITIC STAINLESS STEEL DURING HIGH ENERGY ELECTRON IRRADIATION
B. N. Singh Apr. 1974 20 p refs
(RISO-M-1712) Avail: AEC Depository Libraries HC $4.00

Thin foils of an austenitic stainless steel with and without dispersions of aluminum oxide particles are irradiated in a high-voltage electron microscope at 600 C; prior to irradiation, up to 1000 ppM of helium atoms are implanted in the thin foils. The void concentration and the swelling decreased with decreasing size of the grains irradiated; the effect of grain size being more marked in the dispersed specimens. The dose dependencies of void size and swelling for grains of different sizes and with different helium concentrations are described. Results are analyzed in terms of grain size dependent vacancy supersaturation. It is concluded that void nucleation is critically dependent on vacancy supersaturation and that the grain size effect is predominantly nucleation controlled. Author (NSA)

N75-11733# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
VARIATION OF STANTON NUMBER WITH PRANDTL NUMBER FOR ROUGH AND SMOOTH SURFACES AT GAS-COOLED REACTOR CONDITIONS
H. G. Lyall and M. A. M. Pirie Feb. 1974 14 p refs
(RD/B/N-2857; RPC/HT/N-(73)29) Avail: AEC Depository Libraries HC $4.00

Consideration is given to heat transfer from rough and smooth surfaces in the range of Prandtl number and Reynolds number normally obtained in gas cooled nuclear reactors, and for values of the surface-to-bulk temperature ratio close to unity. It is shown that for both types of surface Stanton number varies as Prandtl number to the power -0.4, rather than the widely-used -0.6. A modified Reynolds analogy, St = 0.98(f/2)Pr to the minus 0.4 power is shown to correlate the smooth tube data very well in this range. It gives results over 10% lower than the Dittus-Boelter correlation. At much lower Reynolds number, such as might occur in a reactor under fault conditions, a weaker Prandtl number dependency occurs with rough surfaces, but a stronger one with smooth surfaces. This phenomenon is explained qualitatively. Author (NSA)

N75-11734# European Organization for Nuclear Research, Geneva (Switzerland).
DYNAMIC ORIENTATION OF NUCLEI AT LOW TEMPERATURES. A STUDY OF THE MECHANISMS OF DYNAMIC POLARIZATION IN POLARIZED TARGETS
W. DeBoer 13 May 1974 67 p refs
(CERN-74-11) Avail: AEC Depository Libraries HC $6.50

The mechanisms of dynamic orientation of nuclei were studied in organic materials at temperature below 1 K and magnetic fields up to 50 kG. The dynamic polarization experiments in diols, doped with paramagnetic Cr(V) -complexes, are described. These measurements are compared quantitatively with a spin temperature model, in which the polarization of the nuclei is obtained via the thermal contact with a dynamically cooled electron spin-spin interaction reservoir. The observed high polarizations make this kind of material attractive for polarized targets. A pure tensor polarization of deuterons in a solid was obtained by slightly off-resonance irradiation of the proton spin system in partially deuterated diols. The results could be understood quantitatively in terms of the spin temperature theory. The dynamic polarization experiments with the free radical BDPA are described. The polarizations of different nuclei show clearly the contributions of different mechanisms of dynamic polarization. Author (NSA)

N75-11735# United Engineers and Constructors, Inc., Philadelphia, Pa.
HIGH TEMPERATURE GAS-COOLED REACTOR PLANT. VOLUME 5: 770-MW(e) CENTRAL STATION POWER PLANTS INVESTMENT COST STUDY
Dec. 1973 328 p refs
(Contract AT(11-1)-2226)
(WASH-1230-Vol-5) Avail: NTIS HC $9.50

An investment cost study on a 770 MW(e) nominally rated high temperature gas cooled reactor central station power plant was conducted for the purpose of presenting detailed cost information which could be used in making cost comparisons, evaluations, and projections relative to alternative types of nuclear and fossil power plants. NSA

74 OPTICS

Includes light phenomena.

N75-11736# Cornell Univ., Ithaca, N.Y. Materials Science Center.
ABSORPTION SPECTRA OF GLASSES IN THE FAR INFRARED M.S. Thesis
C. L. Cabrera Jan. 1974 70 p refs
(Contract AT(11-1)-3151)
(COO-3151-30; Rept-2072) Avail: NTIS HC $3.25

Precise measurements were made of the far infrared absorption coefficient of several glasses, vitreous silica, GeO2, and CaK(NO3) sub 3, using Fourier transform spectroscopic techniques which employed a Michelson or a lamellar-grating interferometer. The samples were kept at 42 K, and a helium-3 cooled (0.3 K) germanium bolometer was used as a detector. Multiple reflections within the samples were considered in arriving at the absorptivity. Author

N75-11737# Army Foreign Science and Technology Center, Charlottesville, Va.
OPTICAL IMAGE RECORDING OF MAGNETIC TAPES WITH BAND DOMAINS AT THE POINT OF COERCIVE FORCE
I. A. Panshin, E. A. Podpalyi, and V. A. Fabrikov 25 Feb. 1974 6 p refs Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), no. 6, 1972 p 457-459
(AD-784754; FSTC-HT-23-1787-73) Avail: NTIS CSCL 14/3

A new method of optical image recording on magnetic tapes is described. When segments of the tape are heated, the coercive force decreases and a change of width of band domains occurs. A recording field is applied to the tape, and this enables better results to be obtained. GRA

N75-11738# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF IMAGE FORMATION IN COHERENT LIGHTING
V. N. Kurbatov and G. N. Pavlygin 9 Aug. 1974 10 p refs Transl. into English Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 16, no. 4, Jul./Aug. 1971 p 301-303
(AD-784264; FTD-HC-23-1681-74) Avail: NTIS CSCL 20/6

The goal of the report is to examine the features of visual observation of coherently illuminated images and to compare theoretical concepts with experimental data. GRA

N75-11739# ARO, Inc., Arnold Air Force Station, Tenn.
REGULAR NORMAL TRANSMITTANCE OF ROUGHENED DIELECTRIC INTERFACES: COMPARISON OF THEORY AND DATA Final Report, 1 Jan. 1973 - 4 Jan. 1974
A. M. Smith AEDC Sep. 1974 27 p refs
(ARO Proj. VF202; ARO Proj. VF402)
(AD-784751; ARO-VKF-TR-21; AEDC-TR-74-35) Avail: NTIS

CSCL 20/6

The theory for the regular normal transmittance of a rough dielectric interface is compared with experimental results. Relative regular transmission data from a very novel experiment involving variation of interface refractive index ratio and root-mean-square (rms) roughness at a single wavelength are found to be in excellent agreement with the theoretical transmittance relation for a rough dielectric interface having a Gaussian distribution of surface heights. Also, absolute spectral transmission measurements for rock-salt (NaCl) windows roughened on both faces are found to be in good agreement with the regular transmittance theory at wavelengths where absorption and surface scattering are negligible. Author (GRA)

N75-11740# Perkin-Elmer Corp., Norwalk, Conn.
GUERAP 2: USER'S GUIDE Technical Report, Jun. 1971-Jun. 1973
Bruce Bouce, Duncan Harris, and Robert Noll Feb. 1974 215 p refs
(Contract F04701-71-C-0376)
(AD-784874; PE-11615; SAMSO-TR-73-309) Avail: NTIS CSCL 20/6

This report describes a General Unwanted Energy Rejection Analysis Program (GUERAP). In addition to being a user's guide for the program, the report presents the theory behind the program. A deterministic approach to stray light computation is presented in terms of: (1) differential ray trace methods; (2) a ray theory of diffraction; (3) a set of perturbative view factor matrices which allow the more important stray light effects to be calculated first. Some experimental verification of the calculated results is presented, as well as a description of how to use the program. Author (GRA)

N75-11429* Scientific Translation Service, Santa Barbara, Calif.
SCATTERING OF LIGHT IN A SPHERICAL MULTILAYER ATMOSPHERE
L. G. Titarchuk *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 85-120 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 72-105 (For availability see N75-11419 02-43)
CSCL 20F

N75-10992* Kanner (Leo) Associates, Redwood City, Calif.
PHOTOGRAMMETRIC METHOD OF DETERMINATION OF DEFLECTION OF LIGHT BEAMS BY PORTHOLE GLASS UNDER SPACE FLIGHT CONDITIONS
Ya. L. Ziman *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 36-41 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 24-27 (For availability see N75-10988 02-18)
CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N75-11741*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
REFLECTION BEAM ISOLATOR FOR SUBMILLIMETER WAVELENGTHS
M. Kanda (NBS, Boulder, Colo.) and W. G. May 1974 2 p refs
(Grant NGL-06-003-088)
(NASA-CR-140761) Avail: NTIS HC $3.25 CSCL 20I

Magnetoplasma reflection beam isolators for submillimeter wave use are discussed. The basic configuration used is that of the Kerr transverse magneto-optical effect. Theoretical and experimental data at 337 microns using InSb as a plasma are given. Author

N75-11742*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPOKE WAVENUMBERS AND MODE TRANSITIONS IN THE NASA LEWIS BUMPY TORUS
Glenn A. Gerdin 1974 18 p refs Presented at the 16th Ann. Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Albuquerque, N. Mex., 28-31 Oct. 1974
(NASA-TM-X-71624) Avail: NTIS HC $3.25 CSCL 20I

Waveforms of fluctuations of plasma potential, resulting from rotating electron and ion charge concentrations, were observed in a bumpy torus. Since these fluctuations were thought to be spoke rotations in the direction of the ExB drift, measuring the direction of spoke rotation should determine the direction of the electric fields over much of the plasma surface. A Langmuir probe was inserted into the plasma to measure the floating potential of the plasma, hence the direction of the electric field could be checked another way. Author

N75-11743# Sandia Labs., Albuquerque, N.Mex.
ELECTRON-BEAM-INDUCED FUSION
E. H. Beckner Mar. 1974 7 p
(Contract AT(29-1)-789)
(SLA-74-122) Avail: NTIS HC $3.25

There is increasing interest in the use of tightly focused relativistic electron beams, as an alternative to lasers, for heating and compressing matter to achieve fusion. Introductory information on the promising aspects of the electron beam technique, the problems involved, and the areas to be investigated with a view to improving the technology is presented. Author (NSA)

N75-11744# Sandia Labs., Albuquerque, N.Mex.
COMPARISON OF SOME THEORIES OF RADAR BACKSCATTERING BY TURBULENT PLASMA WITH APPLICATION TO CLUTTER CALCULATIONS
W. D. Brown May 1974 20 p refs
(Contract AT(29-1)-789)
(SLA-73-1071) Avail: NTIS HC $3.25

The backscattering of radar by turbulent ionized gas in a nuclear environment appears to make an important contribution to radar clutter. It is customary to use the first Born approximation in computing this backscattering. Other methods of computing radar backscattering, such as a Born eikonal approximation, which treats the ensemble averaged properties of the turbulent plasma in an eikonal approximation and the fluctuating properties in a perturbation expansion, and a stochastic transport theory, which is similar to radiation transport theory, are described. These methods are compared with the Born approximation in the context of a nuclear environment, and numerical results obtained with a model of a turbulent ionized gas are presented. Author (NSA)

N75-11745# California Univ., Livermore. Lawrence Livermore Lab.
OUTLOOK FOR FUSION ENERGY SOURCES: REMAINING TECHNOLOGICAL HURDLES
R. F. Post 20 Mar. 1974 26 p Presented at 140th Meeting of the Am. Assoc. for the Advan. of Sci., San Francisco, 25 Feb. 1974 Sponsored by AEC
(UCRL-75418; Conf-740213-6) Avail: NTIS HC $3.75

Controlled fusion research is now in its third decade. Through this effort most of the critical scientific issues for the main approach to fusion-magnetic confinement-have been resolved. Remaining critical scientific questions are mainly quantitative in nature, and have to do with residual instabilities of the confined fusion plasma. Laser fusion, much newer on the scene, also has critical quantitative issues to resolve, issues that will be addressed in the next few years. Author (NSA)

N75-11746# California Univ., Livermore. Lawrence Livermore Lab.
SUPERTHERMAL ELECTRON DISTRIBUTIONS IN LASER-PRODUCED PLASMAS
H. D. Shay, D. Bailey, S. Bodner, J. Katz, W. Kruer, J. Nuckolls, W. Slivinsky, E. Valeo, and G. Zimmerman 11 Apr. 1974 24 p refs Presented at the 7th European Conf. on Plasma Production by High Power Lasers, Garching, West Germany, 22 Apr. 1974 Sponsored by AEC
(UCRL-75465; Conf-740439-2) Avail: NTIS HC $3.25

A review of the program at LLL to determine the heating of superthermal electrons during the irradiation of CD2 targets at the Long Path Laser Facility is presented. The review covers plasma simulation work with the hydrodynamic code LASNEX along with some experimental results. NSA

N75-11747# Columbia Univ., New York.
RESEARCH IN COMPUTATIONAL PLASMA PHYSICS. Progress Report, 1 Jun. 1973 - 31 May 1974
C. K. Chu 31 May 1974 13 p refs
(Contract AT(11-1)-3086)
(COO-3086-27) Avail: NTIS HC $3.25

Problems considered in the research include all two-dimensional simulations of the shock tube, the vacuum field calculation for the divertor section of the tube, and a numerical study of the proper boundary conditions for fluid codes. Two-dimensional simulation of toroidal pinches was also begun. NSA

N75-11748# Sandia Labs., Albuquerque, N.Mex.
ELECTRIC FIELD MEASUREMENTS IN LASER PLASMAS
C. W. Mendel 10 Jun. 1974 4 p Presented at the 8th Intern. Quantum Electron. Conf., San Francisco, 10 Jun. 1974 Sponsored by AEC
(SLA-74-5001; Conf-740617-2) Avail: NTIS HC $3.25

Electric fields in laser produced plasmas were measured on a nanosecond time scale by observing the deflection versus time of a small diameter, low current proton beam. Fields of 0.5 kV/cm were observed 2 cm from CH2 spheres irradiated by 1 J, 25 picosecond pulses from a Nd laser. Measurements closer to the target are also reported. Author (NSA)

N75-11749# Paris Univ., Orsay (France).
STUDY OF THE COLLISION BROADENING OF HeI LINES EMITTED BY A DENSE He PLASMA JET Ph.D. Thesis
C. S. Diatta [1974] 119 p refs In FRENCH
(FRNC-TH-449) Avail: AEC Depository Libraries HC $9.00

Comparisons are made between theoretical and experimental profiles obtained for some isolated and nonisolated HeI lines observed in helium plasma jets having well defined characteristics (electron density, temperature). The agreement between experiment and the GRIEM theory (in which the ions are considered to be stationary particles) is very satisfactory (except for the 5875A line) when the experimental errors are taken into consideration (10%). The very large discrepancies (30 to 50%) obtained by KUSCH were not observed in successive measurements of the electron density N(e) of a helium-hydrogen plasma from broadening of the H(beta) line and HeI lines. The differences observed between the experimental and theoretical 4471.5A and 4921.93A hydrogen like lines indicate, however, that in certain cases it is absolutely necessary to take the motion of the ions into consideration. NSA

N75-11750# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
IONIZATION INSTABILITY IN A MAGNETIZED LOW TEMPERATURE PLASMA AND ITS INFLUENCE ON THE ELECTRICAL CONDUCTIVITY OF NONEQUILIBRIUM PLASMA IN MHD GENERATORS
V. Zampaglione 29 Nov. 1973 162 p refs
(RT/FI-(73)42) Avail: AEC Depository Libraries HC $12.25

The plasma stability analysis has become one of the main fields of physical research on gaseous magnetohydrodynamic generators, as nonuniformities in the plasma properties may significantly impair output and efficiency of energy conversion. A review and discussion are given of the up to date investigations (with special reference to the theoretical analysis) on the plasma nonuniformities due to the onset of ionization instability in a weakly ionized low temperature gas placed in electric and magnetic fields and on their relevant effects on the performance of nonequilibrium MHD generators. Author (NSA)

N75-11751# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
EXPERIMENTAL STUDY OF THE STARK BROADENING OF THE LAMBDA EQUALS 4471.48 AND 4470.04A HeI SPECTRAL LINES EMITTED BY A PLASMA Ph.D. Thesis - Paris Univ., Orsay
J. Ramette Oct. 1973 169 p refs In FRENCH
(EUR-CEA-FC-707) Avail: AEC Depository Libraries HC $11.50

A detailed study was made of the profile of the HeI lambda = 4471.48 A line and its forbidden component at lambda = 4470.04 A, emitted for an afterglow plasma having electron densities ranging from 1.5 x 10 to the 15th power/cucm to 2.2 x 10 to the 14th power/cucm and electron temperatures lying between 6300 K and 3400 K. A detailed description is given of the experimental device and the spectroscopic assembly for measuring the plasma parameters and the line profiles. The electron density was measured using laser interferometry. The electron temperature was determined spectroscopically from the Boltzmann plot of the population densities of highly excited He levels (principal quantum number $n < 11$). A ten channel analyzer served for measuring the line profiles. It was found that the wavelength shifts of the individual components and, thus, the peak separation are slightly smaller than predicted by theory, whereas the intensity in the valley between the two components is found to be slightly larger than the theoretical value. NSA

N75-11752# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
EQUILIBRIUM PROBLEMS IN MAGNETOHYDRODYNAMICS
G. M. Bouligand Jan. 1974 22 p refs In FRENCH
(EUR-CEA-FC-724) Avail: AEC Depository Libraries HC $4.25

In local domains, MHD systems generally admit Euclidian solutions which can be extended to infinity. Nevertheless, difficulties arise when topographical conditions are imposed, thus implying a periodicity, i. e., closing of isobaric surfaces. Overall solutions are sought. In Euclidian space, helicoid symmetry generalizes symmetry of revolution and leads to solutions having restrictions. An attempt was made to discover the origin of overall equilibrium properties using less restricted equations. In this way, the Hamada coordinate system can be introduced using a metric tensor. This leads to the existence of overall equilibria in Riemann spaces. Without involving small momenta changes, it is shown that the energy principle can be extended to Riemannian spaces using gradient, divergence, and curl operators and that the reduction of a Riemannian space into a Euclidian space does not in any way alter the stability and instability predictions. NSA

N75-11753# United Kingdom Atomic Energy Authority, Culham (England).
MEDUSA: A ONE-DIMENSIONAL NUMERICAL MODEL FOR LASER FUSION CALCULATIONS
J. P. Christiansen, D. E. T. F. Ashby, and K. V. Roberts Dec. 1973 15 p refs
(CLM-R-130) Avail: AEC Depository Libraries HC $4.00

The physics and mathematics used in MEDUSA, a computer code designed for calculating the compression of a plasma by laser radiation together with the thermonuclear reactions that take place, are described. The physical processes and mathematical formulas are described. The numerical techniques employed in the model are discussed. Author (NSA)

N75-11754# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
TURBULENT HEATING AND QUENCHING OF ION SOUND INSTABILITY
C. T. Dum, R. Chodura, and D. Biskamp Jan. 1974 16 p refs
(IPP-6-122) Avail: AEC Depository Libraries HC $4.00

Turbulent heating and stabilization of the ion acoustic instability was investigated by 2 D computer simulation. Quasilinear rather than nonlinear effects determine the evolution of the instability. The growth rate is reduced by flattening of the electron distribution and finally the instability is quenched by the formation of a high energy ion tail. Author (NSA)

N75-11755# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STUDY OF PLASMA SYSTEMS WITH CLOSED ELECTRON DRIFT AND DISTRIBUTED ELECTRIC FIELD
Yu. V. Esipchuk 24 Jul. 1974 21 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" USSR, 1973 p 75-84 (FTD Proj. T74-04-03)
(AD-784018; FTD-MT-24-1052-74) Avail: NTIS CSCL 20/9

The fundamental features of plasmas with a distributed electric field are discussed along with accelerators with closed electron drift and extended zone of acceleration (UZDP). Fluctuations in

UZDP, plasma optics, and the electromagnetic plasma trap are also discussed. F.O.S.

N75-11756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STEADY-STATE ELECTROMAGNETIC ACCELERATION OF PLASMA IN AN EXTERNAL AXISYMMETRIC MAGNETIC FIELD
I. N. Ostretsov 2 Aug. 1974 15 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" USSR, 1973 p 120-125
(AD-784697; FTD-MT-24-1059-74) Avail: NTIS CSCL 20/9

The instabilities which develop in the jet of an end low-current accelerator are analyzed to show the processes during which the rotary instability of the electrodynamic discharge occurs. The three characteristics regions are identified as: (1) weak magnetic field in which the formation of rotary instability is connected with the presence of the external magnetic field, (2) powerful magnetic field, weak current in which the entire mass of the working medium participates in rotation, and (3) powerful magnetic field, heavy current in which the amplitude of routine oscillations falls sharply and the onset of powerful incoherent oscillation is observed. Author

N75-11757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE MECHANISM OF THE HOMOGENEOUS POSITIVE COLUMN IN OXYGEN LOW-PRESSURE DISCHARGE
Heinz Sabadil 7 Aug. 1974 23 p refs Transl. into ENGLISH from Beitr. Plasmaphys. (East Germany), v. 11, no. 1, 1971 p 53-66
(AD-784256; FTD-HC-23-1387-74) Avail: NTIS CSCL 20/9

The elementary processes determining the discharge mechanism of low-pressure oxygen discharge are reviewed. The fundamental equations for a theory of the quasi-neutral axial homogeneous positive column are derived. The ionization and charge transport mechanism are discussed. GRA

N75-11758# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PULSED PLASMA ACCELERATORS
A. A. Kalmykov and L. V. Leskov 15 Aug. 1974 19 p refs Transl. into ENGLISH from Plazmennye Uskor. (USSR), 1973 p 183-191
(FTD Proj. T74-04-03)
(AD-784699; FTD-MT-24-1072-74) Avail: NTIS CSCL 20/9

The paper presents an analysis of the results obtained during the investigation of pulsed plasma accelerators. GRA

N75-11759# Naval Research Lab., Washington, D.C.
STIMULATED CYCLOTRON RESONANCE SCATTERING AND THE PRODUCTION OF POWERFUL SUBMILLIMETER RADIATION Final Report
P. Sprangle and V. L. Granatstein Jul. 1974 13 p refs
(AD-784401; NRL-MR-2834) Avail: NTIS CSCL 20/9

Interaction of a high frequency electromagnetic pump wave with a magnetized plasma is analyzed. Enhanced growth rates for parametric instability are found near cyclotron resonance. The result implies that tunable, high power, submillimeter sources could be developed using intense relativistic electron beams. Author (GRA)

N75-11760# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF THE CHARACTERISTICS OF STABILIZED ELECTRIC ARC HEATING OF GASES AT HIGH PRESSURES
I. I. Suksov and M. P. Levin 13 Aug. 1974 15 p refs Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk (USSR), no. 3, 1969 p 100-105
(AD-784249; FTD-HT-23-1806-74) Avail: NTIS CSCL 20/9

The authors give relationships for the calculation, by the method of successive approximations, of the electrical and thermal characteristics during stabilized (asymptotic) heating of a gas from the column of an electric arc in a circular duct, with consideration of radiation. A simplified method is proposed for estimating the effect of radiation on the basis of data on the degree of blackness of the plane-parallel layer or of the hemispheric volume. The results of the calculations for air are given. GRA

N75-11761# Naval Postgraduate School, Monterey, Calif.
MEASUREMENTS OF EARLY MAGNETIC FIELDS IN LASER PRODUCED PLASMAS M.S. Thesis
Bernd Wegener Jun. 1974 83 p refs
(AD-784763) Avail: NTIS CSCL 20/9

A plasma was produced by irradiation of an aluminum target with a 280MW, 25 nsec pulse from a neodymium-doped glass laser. The resulting plasma expanded into an ambient background of 0.00005 Torr to 1000 M Torr and was analyzed using floating double probes and magnetic probes. An early magnetic field was observed which arrived at the probe position before the main plasma. The strong reversed field observed at the front of the laser plasma is attributed to the development of an axial electron temperature gradient due to snowplowing of the ambient plasma and to the larger radial density gradient. (Modified author abstract) GRA

N75-11762# Rensselaer Polytechnic Inst., Troy, N.Y. Plasma Dynamics Lab.
CONTROL SYSTEM FOR ADVANCED PLASMA ENERGY AND PROPULSION SOURCE Final Report
Robert L. Hickok and William C. Jennings Mar. 1974 8 p refs
(Grant AF-AFOSR-2191-72; AF Proj. 9752)
(AD-784945; RPDL-74-3; AFOSR-74-1297TR) Avail: NTIS CSCL 20/9

An ion beam probe has been used to measure the density, space potential and electron temperature in a hollow cathode arc and the results compared with Langmuir probe measurements. Feedback stabilization of a coherent instability, using an amplitude modulated carrier frequency that is inductively coupled to the plasma, has been demonstrated. Author (GRA)

N75-11763# California Univ., Los Angeles. School of Engineering and Applied Science.
RAY AND EXPLOSIVE SOLUTIONS OF NONLINEAR EVOLUTIONAL EQUATIONS IN HILBERT SPACE Interim Report
P. K. C. Wang Jul. 1974 27 p refs
(Grant AF-AFOSR-2662-74; AF Proj. 9752)
(AD-784848; AFOSR-74-1404TR) Avail: NTIS CSCL 20/9

Many nonlinear phenomena occurring in physical systems are describable by a set of ordinary, partial or functional differential equations which can be regarded as an evolutional equation in a suitable abstract vector space. In this paper, the author considers nonlinear evolutional equations defined on Hilbert spaces. Attention is focused on developing conditions for the existence of solutions which lie along half-rays emanating from the origin of the space. The results are used to establish sufficient conditions for the existence or nonexistence of explosive solutions or solutions having finite escape time. The paper concludes with a discussion of the application of some of the results to specific classes of evolutional equations arising from physical situations. Author (GRA)

N75-11764# Avco-Everett Research Lab., Everett, Mass.
DEVELOPMENT OF EXPLOSIVELY DRIVEN MHD GENERATOR FOR SHORT PULSE AIRCRAFT HIGH POWER. PART 1: ANALYTICAL STUDIES. PART 2: EXPERIMENTAL STUDIES. PART 3: DESIGN STUDIES Interim Technical Report
J. Teno and O. K. Sonju Jun. 1974 476 p refs
(Contract F33615-72-C-1395; AF Proj. 3145)
(AD-784903; AFAPL-TR-74-48; ITR-1) Avail: NTIS CSCL 10/2

The main objective of the work was feasibility demonstration of compact high performance explosively driven MHD generators. The work performed here was of both an analytical and experimental nature, including studies of explosives, detonation, expansion of detonation products, evaluation of the conductivity of expanded gases resulting from detonation of the explosive charge. This work provides a sound foundation for work that may be conducted in the future and would permit such a program to begin with the fabrication of a model high performance test XMHD generator. Author (GRA)

N75-11765# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE USE OF PLASMA ACCELERATORS IN TECHNOLOGY
S. D. Grishin and N. P. Kozlov 2 Aug. 1974 22 p refs Transl. into ENGLISH from the book "Plazmennye Uskoriteli" USSR, 1973 p 15-25
(AD-784850; FTD-MT-24-1043-74) Avail: NTIS CSCL 20/9

The article discusses three basic directions of the practical use of plasma accelerators: the use of plasma accelerators in industry; the use of plasma accelerators in experimental techniques; the use of plasma accelerators in astronautics. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N75-11766*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
HOLLOW-CYLINDER WAVEGUIDE ISOLATORS FOR USE AT MILLIMETER WAVELENGTHS
M. Kanda (NBS, Boulder, Colo.) and W. G. May 1974 21 p refs
(Grant NGR-06-003-088)
(NASA-CR-140760) Avail: NTIS HC $3.25 CSCL 20L

A semiconductor waveguide isolator consisting of a hollow column of a semiconductor mounted coaxially is considered in a circular waveguide in a longitudinal dc magnetic field. An elementary and physical analysis based on the excitation of plane waves in the guide and a more rigorous mode matching analysis are presented. These theoretical predictions are compared with experimental results for an InSb isolator at 94GHz and 75 K. Author

N75-11767*# Boeing Aerospace Co., Huntsville, Ala. The Nuclear and Space Physics Group.
FURTHER ANALYSIS OF FIELD EFFECTS ON LIQUIDS AND SOLIDIFICATION. STUDY OF THE LIQUID-SOLID TRANSITION FOR MATERIALS PROCESSING IN SPACE Final Report
R. F. Seiler, R. I. Miller, and W. S. Chen Nov. 1974 35 p refs
(Contract NAS8-28664)
(NASA-CR-120528; D256-10024-Add) Avail: NTIS HC $3.75 CSCL 20L

Expressions for diffusion coefficient, D, and solidification rate, Uc, from the free volume model of liquids developed by Turnbull and Cohen have been used to estimate the effects which microgravity and magnetic fields will have on these quantities. The mathematical formalism describing changes in D and Uc is the same for both the microgravity and magnetic field cases, but the difference between the magnitudes of the two effects is quite large. The change in D and Uc is found to be less than 0.0001% for the microgravity case and on the order of 0.1 to 1.1% for the magnetic field case for four representative materials. D and Uc are found to increase under the influence of an applied magnetic field, and this is in agreement with experimental observations. Author

N75-11768# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SUPERCONDUCTIVITY IN METASTABLE SIMPLE CUBIC ALLOYS
W. L. Johnson and S. J. Poon Mar. 1974 11 p refs
(Contract AT(04-3)-822)
(CALT-822-60) Avail: NTIS HC $3.25

Results of resistivity measurements and X-ray studies of four new metastable simple cubic superconducting alloys are presented. It is shown that in general, superconducting phases with simple cubic structure obey the sa ue valency rules as the A-15 compounds. Common features, including the existence of orthogonal chains of atoms for these two crystalline phases, are discussed in conjunction with superconductivity. Author (NSA)

N75-11769# Sandia Labs., Livermore, Calif.
PHOTO-COMPTON CURRENTS AT MATERIAL INTERFACES: THEORY AND EXPERIMENT
T. A. Dellin, K. W. Dolan, and C. J. MacCallum Mar. 1974 8 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Fort Collins, Colo., 15 Jul. 1974
(Contract AT(29-1)-789)
(SLL-74-5226; Conf-740707-3) Avail: NTIS HC $3.25

The effects of a photon flux incident on the interface between two different materials which generates an electron flux which produced nonlocal energy and charge distributions within an electron range of the interface are investigated theoretically and experimentally. A previous method is extended to determine algebraic formulas for the electron number current, energy current, and energy deposition at the one-dimensional interface between two materials. The electron current at the interface between two similar and dissimilar materials was measured. NSA

N75-11770# Sandia Labs., Livermore, Calif.
UPPER AND LOWER BOUNDS ON THE VACUUM PHOTOEMISSION FROM MULTI-DIMENSIONAL SURFACES
T. A. Dellin Mar. 1974 8 p Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Fort Collins, Colo., 15 Jul. 1974
(Contract AT(29-1)-789)
(SLL-74-5225; Conf-740707-2) Avail: NTIS HC $3.25

It is shown that it is possible to construct rigorous upper and lower bounds on the magnitude of emission from a general convex or concave surface. The superposition approximation is used with some simple and accurate analytical formulas, and the important case of the bounds on the emission from a cylindrical wire is considered in detail. NSA

N75-11771# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRONIC STRUCTURE OF COMPLEX CRYSTALLINE AND AMORPHOUS SEMICONDUCTORS Ph.D. Thesis
J. Joannopoulos May 1974 220 p refs
(Contract W-7405-eng-48)
(LBL-2724) Avail: NTIS HC $7.25

The electronic structure of some complex crystalline and amorphous phases of Group 4, binary and Group 6 compounds was studied with emphasis on understanding the effects of long-and short-range order and disorder. The effects of long-range order were studied by comparisons of calculations of charge densities of ZnS in the zinc blende and wurtzite structures using the empirical pseudopotential method (EPM). A scheme is presented for obtaining the charge density from only a few representative k (bar) vectors. Effects of short-range order and disorder were studied by an examination of the band structures, electronic densities of states, and optical properties of Ge and Si in the diamond, wurtzite, BC-8, and ST-12 crystal structures using the EPM and simple tight binding models. A complete band structure, critical point analysis and group theoretical discussion of the wurtzite, BC-8 and ST-12 structures are presented. Dipole matrix elements P(E) and joint densities of states J (E) are calculated and examined in order to discern information about the effects of disorder on the optical properties. In addition, a method is introduced to obtain the density of states of an infinite system using only information about local topologies. Author

N75-11772# California Univ., Livermore. Lawrence Livermore Lab.
SUBSURFACE PROBING BY MEASUREMENT OF THE WAVE TILT OF ELECTROMAGNETIC SURFACE WAVES
J. Lytle, E. Laine, and D. Lager 15 Apr. 1974 32 p refs
(Contract W-7405-eng-48)
(UCRL-51567) Avail: NTIS HC $3.75

An overview is presented concerning the tilt of an electromagnetic surface wave propagating along the surface of the earth. It is thought that wave tilt measurements have important applications in geophysical probing of permafrost regions. Specific applications include locating and determining the extent of coal, sand, gravel, and ore deposits, and learning the depth of permafrost. Calculations show that when the active layer of permafrost is frozen, it may be feasible to probe to significant depths using high frequencies (>1 MHz). This enables resolution of thicknesses of layers, a result that was not possible at lower frequencies. Wave tilt measurements can be presented in terms of a lithogram, which is analogous to an ionogram. Differences

in wave tilt occur in surface waves generated by vertically oriented electric and magnetic dipoles. These wave tilt differences may be useful because they allow more data to be obtained. Author

N75-11773# Ames Lab., Iowa.
BONDING AND PHASE TRANSITION IN (Ti,V)S SOLID SOLUTIONS M.S. Thesis
D. H. Leebrick Mar. 1974 75 p refs
(Contract W-7405-eng-82)
(IS-T-629) Avail: NTIS HC $4.25

The lattice parameters, density, and composition of samples in the (Ti,V)S system were determined, and percentage occupancies, valence electron concentrations, and unit cell volumes are derived. Group theory was used to show that the symmetry requirements, for a second order phase transition are satisfied for a MnP to NiAs phase transition. It was shown that to within the limits of experimental detectability, the physical requirements for a second order phase transition are also met by this system. A likely explanation for the transition is proposed in terms of valence electron concentrations and band theory. Author (NSA)

N75-11774# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
BEHAVIOR OF SEMICONDUCTOR DEVICES AT LOW TEMPERATURES
B. Lengeler, S. Matula, J. Spormann, and G. Durcansky Nov. 1973 106 p refs In GERMAN
(JUL-1021-FF) Avail: AEC Depository Libraries HC $8.50

The temperature behavior of the most important semiconductor properties was investigated and literature data compiled. The properties studied were band gap, ionization energy of impurity atoms, density of free charge carriers, mobility, electric and thermal conductivity, impact ionization, life-time of charge carriers, and noise. The following components were studied: diodes, varactor diodes, Zener diodes, tunnel diodes, Si and Ge semiconductor detectors, bipolar transistors and FET's. The measured results are compared with those of other authors and discussed. A hf oscillator is described for the measurement of magnetic fields by means of NMR. NSA

N75-11775# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionale.
DESIGN OF A DIRECT CURRENT SUPERCONDUCTOR DIPOLE
G. Pasotti and M. Spadoni 6 Dec. 1973 28 p refs In ITALIAN
(LNF-73-66) Avail: AEC Depository Libraries HC $4.50

The design specifications of the primary components of a superconductor dipole were calculated. The principal parameters of the magnet are tabulated. NSA

N75-11776# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
ELASTIC INTERACTION AND PHASE TRANSITION IN COHERENT METAL-HYDROGEN SYSTEMS
H. Wagner and H. Horner Jan. 1974 106 p refs In GERMAN; ENGLISH summary
(JUL-1039-FF) Avail: AEC Depository Libraries HC $8.50

Some general properties of the elastic interaction and the importance of boundary conditions for the form of the elastic interaction, which turns out to be the Curie-Weiss type with macroscopic range, are discussed. The gas-liquid phase transition in the hydrogen lattice fluid is investigated. The long-range part of the elastic interaction is treated in mean field approximation. In the canonical ensemble as opposed to the grand canonical ensemble, no coexisting phases near the critical point are found. Instead there is a continuous transition that changes into a first order transition at tricritical points. In the temperature density region that normally corresponds to the two phase coexistence region, the hydrogen density is inhomogeneous and varies on a macroscopic scale. NSA

N75-11777# Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION Annual Progress Report, period ending 31 Dec. 1973
May 1974 164 p refs
(Contract W-7405-eng-26)
(ORNL-4952) Avail: NTIS HC $6.25

Results of research on solid state physics are presented in the areas of particle-solid interactions, electronic and magnetic properties, lattice dynamics, low temperature radiation effects, superconductivity, X-ray diffraction, electron microscopy, ion bombardment, surface properties, radiation damage, optical properties, spin resonance, and magnetic properties. NSA

N75-11778# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRON AUTOACCELERATION
R. J. Briggs, T. J. Fessenden, and V. K. Neil Apr. 1974 6 p Presented at the 9th Intern. Conf. on High Energy Accelerators, Stanford, Calif., 2 May 1974 Sponsored in part by AEC
(Contract NAonr-13-74; ARPA Order 1377)
(UCRL-75337; Conf-740522-16) Avail: NTIS HC $3.25

Theoretical and experimental studies of autoaccelerating electrons in an iris loaded pipe are described. The theory is based on a self consistent one dimensional hydrodynamic model. The computational results indicate that some particles may be accelerated to several times their initial energy provided the proper current vs time is injected, and the initial particle energy is high enough to limit the growth of longitudinal density fluctuations to a tolerable level. An experimental study of the interaction of an intense 3- MeV electron beam with a simple multicavity structure is described, where autoacceleration of some particles by the excited longitudinal RF fields was observed.
Author (NSA)

N75-11779# Danish Atomic Energy Commission, Risoe. Research Establishment.
EXCHANGE INTERACTION IN THE HEAVY RARE EARTH METALS CALCULATED FROM ENERGY BANDS
P. A. Lindgard Feb. 1974 26 p refs
(RISO-M-1701) Avail: AEC Depository Libraries HC $4.50

The indirect exchange interaction (RKKY) is calculated for the heavy rare earth metals. The conduction electrons are treated by the argumented plane-wave (APW) method. Numerical results for the susceptibility for APW and free electrons are given. The numerical accuracy is tested for the free electron model using both a root sampling method and a linearized integral method. The first method requires 450,000 and the latter 9,000 points in the entire Brillouin zone for a good agreement with the Lindhard function. The susceptibility and the wave vector dependent exchange integral is calculated for Gd, Tb, Dy, and Er in the ordered phase. The wave vector dependent exchange integral is calculated for Gd with the inclusion of the matrix element, calculated on the basis of APW functions. Author (NSA)

N75-11780# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH DENSITY OPTICAL MEMORY Quarterly Progress Report, Apr. - Jun. 1974
Jul. 1974 16 p
(Contract N00014-67-A-0305-0015)
(AD-784690) Avail: NTIS CSCL 09/2

Fourth quarter activities included research into electron coloration techniques, investigation of acousto-optic deflector and optical system parameters, construction of computer interface and memory control electronics and the construction of a mechanical scanner for demonstrating high density digital and audio recording. Results included the discovery that highly pure KCl:NaCl could be electron colored at room temperature. The resulting crystal was stable at a higher temperature than one colored at liquid nitrogen temperature. Difficulties in obtaining satisfactory resolution with the two axis acousto-optic deflector were traced to unsatisfactory lenses in the optical system. GRA

N75-11781# Army Foreign Science and Technology Center, Charlottesville, Va.
INFRARED EMISSION OF SOME MOLECULAR GASES EXCITED BY FAST ELECTRONS
A. G. Koval, V. T. Koppe, and Ya. M. Fogel 27 Jul. 1973 28 p refs Transl. into ENGLISH from Probl. Kosm. Fiz. (USSR), no. 4, 1969 p 112-133
(AD-784383; FSTC-HT-23-1301-73) Avail: NTIS CSCL 07/4

The infrared spectra (spectral region 7000 11,500 A) of N2, O2, CO CO2, NO, CH4, NH3, H2O molecules excited by fast electrons with energy of 13 kev were investigated. Nitrogen spectrum was also investigated at the energy 150 ev. The spectra

were compared with the spectra of the same gases excited by slow electrons and protons. Assignments and features are discussed. GRA

N75-11782# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF CHROMIUM-DOPED OXIDES Final Report, 1 Nov. 1971 - 1 Nov. 1973
Raymond A. Kjar Nov. 1973 155 p refs
(Contract N00014-72-C-0017)
(AD-783988; C71-1063/501) Avail: NTIS CSCL 20/12

Part I of the report describes results obtained during the investigation of the mechanisms by which chromium-doping of a silicon-dioxide gate insulator may improve the radiation resistance of MOS devices. Part II details the fabrication and testing of a CMOS/SOS 4-bit adder that employed chrome-doped and aluminum ion-implanted gate oxides to provide improved radiation hardness. GRA

N75-11783# Army Foreign Science and Technology Center, Charlottesville, Va.
PHOTOELECTRIC PROPERTIES OF ANTIMONY SESQUISELENIDE-BISMUTH SESQUISULFIDE SYSTEMS
L. G. Gribnyak 31 Aug. 1973 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (USSR), no. 1, 1972 p 140-142
(AD-784298; FSTC-HT-23-1292-73) Avail: NTIS CSCL 20/12

Thin films of a series of alloys of bismuth sesquisulfide and antimony sesquiselenide of varying composition were prepared by evaporating test samples onto a glass substrate in a vacuum. One group of samples was deposited on substrates preheated to various temperatures, another group was deposited on cold substrates and then heat-processed in air. Spectral distribution curves for the photoelectric sensitivity of each group of thin films were plotted. GRA

N75-11784# State Univ. of New York, Plattsburgh. Dept. of Physics.
A. C. CONDUCTION IN BIS (CATENA-POLY (METHYLARSENIC)) AN ORGANIC LADDER POLYMER Interim Report
J. E. Lewis and M. Edris 10 Jul. 1974 37 p refs
(Contract N00014-73-A-0450-0001; NR Proj. 356-560)
(AD-782697; TR-1) Avail: NTIS CSCL 20/12

The dark complex impedance of bis (catena-poly (methylarsenic)), an organic ladder polymer, has been measured as a function of frequency and temperature with a 0.1 volt rms ac signal. Conduction is due to a parallel combination of intrinsic excitation of carriers across an energy gap and ac field assisted carrier hopping between localized centers. A temperature and frequency dependent activation energy is indicated for this process. Polarization phenomena at these low frequencies are also seen in the current-voltage characteristics of the material and in the response of the samples to step function changes in the applied dc voltage. It is thought that this polarization is associated with losses in the intrinsic conduction mechanism. (Modified author abstract) GRA

N75-11785# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PREPARATION AND OPTICAL ENERGY GAP OF EPITAXIAL FILMS OF InAs(1-x)P(x) Physical Science Research Papers
Richard N. Brown and John K. Kennedy 20 Jun. 1974 36 p refs
(AF Proj. 5621)
(AD-784790; AFCRL-PSRP-595; AFCRL-TR-74-0280) Avail: NTIS CSCL 20/12

Fast, sensitive infrared detectors operating in the visible to 3 micrometers range are required by the Air Force for use in ranging, communication, illumination, and target designation systems. The InAs(1-x)P(x) alloy system is an attractive candidate for fulfilling these needs, since it has the potential for use in the preparation of intrinsic infrared detectors with precisely determined peak response wavelengths over the entire range from 0.92 to 3.5 micrometers. This is accomplished by variation of the composition of the alloy, which is accompanied by a corresponding variation in the optical energy gap. Films of InAs, InP and several alloys, InAs(1-x)P(x), where x ranged from 0.034 to 0.774, were deposited by vapor phase epitaxy onto GaAs substrates. The fundamental absorption edge of each compound was measured. The temperature coefficient of the energy gap was also evaluated as a function of composition. (Modified author abstract) GRA

N75-11786# Army Foreign Science and Technology Center, Charlottesville, Va.
PbTe VALENCE BAND
Kolomoyets 19 Apr. 1974 13 p refs Transl. into ENGLISH from Fiz. Tekh. Poluprov. (USSR), v. 1, no. 8, 1967 p 1222-1228
(AD-783754; FSTC-HT-23-2039-72) Avail: NTIS CSCL 20/2

A calculation of the valence band parameters of lead telluride was performed, taking into account the nonparabolic character of the light hole band. The temperature dependence of the thermo-emf and Hall electroconductivity coefficients were examined. GRA

N75-11787# Army Foreign Science and Technology Center, Charlottesville, Va.
APPARATUS FOR PRODUCING FILMS OF THERMOELECTRIC MATERIALS
V. A. Naer and V. V. Kravchuk 19 Apr. 1974 7 p refs Transl. into ENGLISH from Kholodiln. Tekh. Tekhnol. (USSR), no. 10, 1970 p 44-48
(AD-783731; FSTC-HT-23-2034-72) Avail: NTIS CSCL 20/12

The method of L. Harris and B. Siegel, known under the name of instantaneous volatilization was used for producing uniform films, identical to the initial material in composition. This method consists of continuously feeding a fine-grained powder of the alloy in small portions to a crucible, which is at a temperature sufficient for volatilization of all components. The substrate temperature must be such as to avoid revolatilization of any condensing component of the alloy. An n-type alloy of the following composition was selected as the initial thermoelectric material: 90% Bi_2Te_3 - 10% Bi_2Se_3 - 0.13% Hg_2Cl_2. GRA

N75-11788# Ford Motor Co., Dearborn, Mich. Scientific Research Staff.
LEAD TELLURIDE PHOTODIODES FOR OPERATION AT 170 K Final Report, Mar. - Dec. 1973
Feb. 1974 146 p refs
(Contract DAAK02-73-C-0225)
(AD-784328) Avail: NTIS CSCL 20/12

This study was undertaken to establish feasibility for the use of epitaxial IV-VI photodiode arrays in thermoelectrically-cooled 3-5 micro imaging systems. The major emphasis has been on 170K performance because this corresponds to an NVL system goal. However, the measurements have covered the range 80-210K, partly to permit evaluation of the detectors in somewhat modified systems and partly in an attempt to understand the temperature-dependence of their performance. In the second phase we have developed band-tailored detectors for extension of the 170K response to 5.0 micro have been developed. GRA

N75-11789# Army Foreign Science and Technology Center, Charlottesville, Va.
APPARATUS FOR THE HIGH-SPEED MEASUREMENT OF THE THERMOELECTRICAL PARAMETERS OF SEMICONDUCTOR MATERIALS IN THE 150-500 K RANGE
N. A. Erasova, V. I. Kaidanov, A. I. Novichkov, and A. B. Nuromskii 27 Feb. 1974 15 p refs Transl. into ENGLISH from Tr. Leningrad. Politekh. Inst. (Leningrad), no. 325, 1971 p 10-15
(AD-784739; FSTC-HT-23-1881-73) Avail: NTIS CSCL 20/12

A method for the rapid determination of thermal conductivity over a wide temperature range proposed by Ye. S. Platunov is used in developing a device for the simultaneous determination of the coefficient of thermoelectromotive force, specific electroconductivity, and thermal conductivity. GRA

N75-11790# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRIC AND PHOTOELECTRIC PROPERTIES OF MONOCRYSTALS OF THE SECTION CdS-In_2S_3
S. I. Radautsan, V. E. Tezlevan, and V. F. Zhitar 15 Apr. 1974

12 p refs Transl. into ENGLISH from the book "Slozhnye Poluprov. i Ikh Fiz. Sovistva, Kishinev, Shtiintsa Press, 1971 p 59-65
(AD-784103; FSTC-HT-12-133-74) Avail: NTIS CSCL 20/12

Results of investigating several photoelectric properties and the temperature dependence of conductivity of monocrystals of the section CdS-In2S3 are presented. GRA

N75-11791# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ELECTRICAL PROPERTIES OF ION IMPLANTED LAYERS IN SILICON AND GALLIUM ARSENIDE
Richard D. Pashley Jan. 1974 122 p refs
(Contract F19628-73-C-0174; AF Proj. 5638)
(AD-784877; AFCRL-TR-74-0171; SR-3) Avail: NTIS CSCL 20/12

Part 1: With the advent of ion implantation, it has become possible to introduce many new dopant species into silicon. The electrical behavior of implanted species displaying deep energy levels was investigated. Part 2: Ion implantation was investigated as a doping process for the fabrication of submicron n-type layers in GaAs. GRA

N75-11792# Aerospace Corp., El Segundo, Calif. Lab Operations.
THE RESPONSE OF Ge:Hg PHOTOCONDUCTORS TO CHOPPED AND SCANNED ILLUMINATION Interim Report
Lee W. Aukerman and Michael F. Millea 6 Sep. 1974 34 p
(Contract F04701-74-C-0075)
(AD-784830; TR-0075(5450-84)-1; SAMSO-TR-74-186) Avail: NTIS CSCL 17/5

Studies were carried out on mercury-doped germanium (Ge:Hg) photoconductors with both chopped and scanned illumination at 3.39 micrometers, over 4 to 5 orders of magnitude in light intensity, and a wide range of pulse widths and background levels. Contrary to the prediction of the dielectric relaxation model, a slightly sublinear response with light intensity was observed. In addition to the dielectric relaxation response time, another time constant that is about two orders of magnitude greater is present. It is this longer time constant that controls the approach to steady state conditions. Signals from focused, scanned beams were compared to those from uniform, chopped beams and showed that little degradation resulted from the focusing effect, but as much as 30 percent degradation could result from scanning. It is suggested that some of these anomalous effects result from the characteristics of the contact at the anode. (Modified author abstract) GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N75-11793# Sandia Labs., Albuquerque, N.Mex.
EXACT SOLUTION TO THE ONE-DIMENSIONAL STATIONARY ENERGY EQUATION FOR A SELF-HEATING SLAB
A. R. Shouman and A. B. Donaldson May 1974 55 p refs
(Contract AT(29-1)-789)
(SLA-74-219) Avail: NTIS HC $4.25

The exact solution of the one-dimensional self-heating problem in Cartesian coordinates is presented. This solution, which defines the behavior of a wide range of self-heating materials, also serves as a gage for the various approximate and numerical solution schemes. In that the solution to the problem leads to integral functions which are evaluated by the use of a computer, the results are presented in tabulated form. Author

N75-11794# D-Cycle Power Systems, Inc., Richmond, Va.
PROOF-OF-PRINCIPLE STUDY OF THE D-CYCLE: A THERMODYNAMIC CYCLE USING MECHANICAL COMPRESSION OF A CONDENSABLE VAPOR Final Report, Jun. 1972 - Dec. 1973
John G. Davoud Feb. 1974 102 p
(Contract DAAK02-72-C-0475; DA Proj. 2A2-50100)
(AD-782904; DCR-741) Avail: NTIS CSCL 20/13

In the D-Cycle, a condensing vapor cycle, there is the potential for improved efficiency in power systems. The contract calls for a feasibility study of the D-Cycle using an organic vapor. The working substance must possess the right thermodynamic characteristics; and the attainment of equilibrium between injected liquid and hot vapor must be fast as determined by the time-frame of the compression stroke in a reciprocating engine. The chosen working fluid is 2-2-2 trifluoroethanol, CF_3CH_2OH, 85% mol-fraction with 15% mol-fraction of water - known as Fluorinol 85 or F 85. A high pressure pump was developed with variable stroke mechanism. Injection of liquid in mist form into vapor at constant volume is accompanied by temperature decrease and pressure increase under the conditions used. State points at minimum and maximum pressures were determined for dry vapor during compression in a motored reciprocating compressor. The D-Cycle depends on a difference between work of expansion at high temperature and reduction of compression work by injection of liquid. The observed results indicate the feasibility of the cycle using F 85 based on published thermodynamic data. GRA

N75-11795# Carnegie-Mellon Univ., Pittsburgh, Pa. Inst. of Science.
NONLINEAR CONTINUUM MECHANICS AND ELECTROMAGNETIC THEORY Final Report
Bernard D. Coleman 29 Jul. 1974 11 p refs
(Grant AF-AFOSR-2057-71; AF Proj. 9749)
(AD-784905; AFOSR-74-1419TR) Avail: NTIS CSCL 20/11

Research is reported in the following areas: A mathematical foundation for thermodynamics, the thermodynamics of discrete mechanical systems with memory, thermodynamics and the stability of motions of materials with memory, fading memory and functional-differential equations, the initial value problem for a class of functional-differential equations, the integral equations of the linear theory of recurrent lateral interaction in vision, the theory of delayed lateral inhibition in the compound eye, the consequences of delayed lateral inhibition in the retina, including the elementary theory of spatially uniform fields and the theory of spatially uniform fields assuming the 4-point property, the theory of induced birefringence in materials with memory, thermodynamic restrictions on the constitutive equations of electromagnetic theory, retardation theorems, and a mathematical theory of lateral sensory inhibition. GRA

N75-11189* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL STUDIES ON THERMODYNAMIC EFFECTS OF DEVELOPED CAVITATION
Robert S. Ruggeri *In* Pennsylvania State Univ. Fluid Mech., Acoustics, and Design of Turbomachinery, Pt. 1 1974 p 377-401 refs (For availability see N75-11174 02-34)
CSCL 20M

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N75-11796# Joint Publications Research Service, Arlington, Va.

TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 436
6 Nov. 1974 30 p refs Transl. into ENGLISH from Eastern Europe reports
(JPRS-63373) Avail: NTIS HC $3.75

Ongoing research activities in Bulgaria and Czechoslovakia are summarized in a series of articles which discuss aspects of radar detection, radio electronic resistor components, and computer technology. For individual titles, see N75-11797 through N75-11799.

N75-11797 Joint Publications Research Service, Arlington, Va.
RESISTANCE OF RADAR SYSTEMS AGAINST INTERFERENCE **c32**
Khristo Popov *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 1-7 Transl. into ENGLISH from Voenna Tekhnika (Sofia), no. 8, 1974 p 26-28 (For availability see N75-11796 02-81)

A mathematical model was developed by Bulgarian scientists which calculates the range of detection of a silent target (an aircraft which does not create disturbances, but flies under the cover of disturbances created by interference aircraft) of a given radar system, and several effective means are discussed for upgrading the individual protection of radar systems from active noise interference. A.A.D.

N75-11798 Joint Publications Research Service, Arlington, Va.
REQUIRED KNOWLEDGE ABOUT RESISTORS DESCRIBED **c33**
Atnas Atanasov *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 8-11 refs Transl. into ENGLISH from Voenna Tekhnika (Sofia), no. 8, 1974 p 28-29 (For availability see N75-11796 02-81)

Standards for radio electronic apparatus are discussed in terms of nominal resistance values, nominal dispersed power, admissible load from the temperature of surrounding air, and the required temperature coefficient of resistance change for component resistors. The various types of manufactured precision resistors produced in Bulgaria are listed. A.A.D.

N75-11799 Joint Publications Research Service, Arlington, Va.
CSAV COMPUTER TECHNOLOGY CHAIRMAN DISCUSSES PROGRESS IN THE FIELD **c62**
Zdenek Volny and Alexej Verner *In its* Transl. on Eastern Europe, No. 436 (JPRS-63373) 6 Nov. 1974 p 12-16 Transl. into ENGLISH from Tvorba (Prague), no. 39, 25 Sep. 1974 p 15 (For availability see N75-11796 02-81)

Installation of up-to-date computers in Czechoslovakian scientific and research institutes is described insofar as current computer uses and capabilities, and plans are described for future accommodation by a centralized computer and information system which would link Czech scientists with research academies in other socialist countries. The practical utility of advanced small table computers, minicomputers, and microcomputers for ongoing research needs is also assessed. A.A.D.

N75-11800*# George Washington Univ., Washington, D.C. Program of Policy Studies in Science and Technology.
OUTPUT ORIENTATION IN R AND D: A BETTER APPROACH?
Guy Black May 1974 24 p refs Sponsored in part by NSF (Grant NGL-09-010-030)
(NASA-CR-140677; Mono-22) Avail: NTIS HC $3.25 CSCL 05A

Research and development management is examined as it might be performed under an output-oriented approach in which the company's needs for innovations in various product and production areas were identified. It is shown that a company's R and D program is the aggregate of its needs in various areas of its business. The planning, programming and budgeting approach is applied to R and D. The state of theory on R and D decision making in economics is summarized. Abstracts of articles concerning R and D in industry are included. Author

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N75-11801# Illinois Univ., Urbana. Coordinated Science Lab.
[RESEARCH PROGRESS IN DATA PROCESSING, GAS DYNAMICS, SEMICONDUCTORS, AND SURFACE ACOUSTIC WAVES] Annual Progress Report, 1 Jul. 1973 - 30 Jun. 1974
R. T. Chien and G. G. Judge Aug. 1974 404 p refs
(Contracts DAAB07-72-C-0259; N00014-67-A-0305-0021; Grants AF-AFOSR-2210-72; NSF GK-36276)
(AD-784222) Avail: NTIS CSCL 05/2

Contents: Surface studies; Surface acoustic waves; Plasma physics; Rarefied gas dynamics; Computational gas dynamics; Semiconductor physics; Display, memory, and computer terminal system research; Photodichroic memory for computer applications; Information science; Advanced automation; Information retrieval research; Networks; Control systems; Digital systems; Population dynamics; Thin films. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N75-11802# Logistics Management Inst., Washington, D.C.
A REVIEW OF GENERAL ACCOUNTING OFFICE DECISIONS ON LIFE CYCLE COSTING
Jun. 1974 119 p refs
(Contract ARPA SD-321)
(AD-783932/7; LMI-74-4) Avail: NTIS HC $5.25

GAO decisions and reports through 1973 which impact the application of life cycle costing procedures on Government procurements are summarized, and 35 specific decisions and reports are abstracted and reviewed. Cross-references and indexes by subject area are also provided. Author (GRA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N75-11803# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
TECHNOLOGY TRANSFER
E. C. W. Perryman Apr. 1974 16 p refs Presented to the Ottawa Chapter of the N. Am. Soc. for Corporate Planning, Inc., 12 Mar. 1974
(AECL-4769; Conf-740336-1) Avail: AEC Depository Libraries

HC $4.00; Atomic Energy of Can., Ltd., Chalk River $0.50

Technological transfer has been an important factor in the development of the CANDU (Canada Deuterium Uranium) reactor system and in the birth and growth of the Canadian nuclear industry. The difficulties involved with technology transfer, whether it be from a Canadian laboratory to Canadian industry, from Canada to another country, or from another country to Canada, are discussed in the light of experience gained during the development of the CANDU reactor system. Author (NSA)

N75-11804# National Scientific Labs., Inc., McLean, Va.
ELECTROMAGNETIC ENVIRONMENT MEASUREMENTS OF PERSONALIZED RAPID TRANSIT SYSTEMS AT TRANSPO 72. VOLUME 9: FORD SYSTEM Final Report, Jan. - Sep. 1972
Earl E. Jamison Jan. 1974 29 p
(Contract DOT-TSC-375)
(PB-233200/5; DOT-TSC-UMTA-72-15-Vol-9; UMTA-MA-06-0031-73-Vol-9) Avail: NTIS HC $3.75 CSCL 13F

The report covers the measurements of the broadband conducted noise present on the ac power lines feeding the personalized rapid transit (PRT) systems at Dulles Airport with each system operating individually. The purpose of the measurement effort was to evaluate the electrical environment existing on each of the PRT hot and neutral ac power lines and to assess the effect of each system on the power line with all other PRT systems turned off. The measurements obtained during this test will be used for a comparison with data obtained with no PRT systems operating and with all four PRT systems operating simultaneously. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N75-11805*# Auburn Univ., Ala. Dept. of Mechanical Engineering.
THERMAL CONDUCTIVITY OF COMETS Final Report
R. I. Vachon, G. N. Kumar, and M. S. Khader Sep. 1974 26 p refs
(Contract NAS8-26579)
(NASA-CR-120524) Avail: NTIS HC $3.75 CSCL 03B

A value is described for the thermal conductivity of the frost layer and for the water-ice solid debris mixture. The value of the porous structure is discussed as a function of depth only. Graphs show thermal conductivity as a function of depth and temperature at constant porosity and density. M.C.F.

N75-11806*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEAR JET TELESCOPE SYSTEM
E. F. Erickson, D. Goorvitch, M. G. Dix, and M. J. Hitchman Sep. 1974 46 p
(NASA-TM-X-62389) Avail: NTIS HC $3.75 CSCL 20F

The telescope system was designed as a multi-user facility for observations of celestial objects at infrared wavelengths, where ground-based observations are difficult or impossible due to the effects of telluric atmospheric absorption. The telescope is mounted in a Lear jet model 24B which typically permits 70 min. of observing per flight at altitudes in excess of 45,000 ft (13 km). Telescope system installation is discussed, along with appropriate setup and adjustment procedures. Operation of the guidance system is also explained, and checklists are provided which pertain to the recommended safe operating and in-flight trouble-shooting procedures for the equipment. A.A.D.

N75-11807*# Arizona Univ., Tucson. Space Astronomy Group.
RESULTS FROM COMPUTER PROGRAM FOR ANALYZING SCATTERED LIGHT SUPPRESSION SYSTEMS FOR LARGE SPACE TELESCOPE
W. G. Tifft and B. B. Fannin 3 May 1974 35 p refs
(Contract NAS8-27804)
(NASA-CR-120530; T-74-2) Avail: NTIS HC $3.75 CSCL 03A

A computer program was developed which has the ability to analyze the performance of most light suppression systems so as to predict the amount of scattered light which will reach the image plane for various conditions of unwanted light input from the sun, earth, or moon. This program was used to analyze three different configurations of the large space telescope (LST): an LST with a truncated sunshield, an LST with an extended cylindrical sunshield, and an LST with a conical sunshield which is tilted upwards. The computer program gives the user detailed information as to the paths taken by the unwanted stray light to reach the image plane, and pinpoints those portions of the light suppression system which contribute most of the stray light, so that areas requiring improvements are evident. Certain design guide lines were formulated for any light suppression system selected for the LST, and one which meets these requirements (the tilted sunshade) is described in detail. Author

N75-11808*# Northwestern Univ., Evanston, Ill.
RAPID VARIATIONS OF BALMER LINE STRENGTHS IN THE SPECTRA OF Be STARS Ph.D. Thesis
Kenneth Bruce McBeath Aug. 1974 94 p refs
(Grant NGR-14-007-122)
(NASA-CR-140812) Avail: NTIS HC $4.75 CSCL 03A

Low resolution photoelectric spectrophotometric measurements of the first four members of the Balmer series in the spectra of one Be and five Be (shell) stars were obtained with the 92-cm telescope and image dissecting scanner. Equivalent widths were computed for each observation, and their standard deviations from the mean values were examined. Results indicate that in three of the program stars, at least one of the Balmer lines shows significant fluctuations in equivalent width. These fluctuations amount to a few per cent of total line strength and the time scales appear to be on the order of three to thirty minutes. The fluctuations are not always present in a given star, indicating that the mechanism producing them may not be continuous. The noncontinuous and nonperiodic nature of the variations, along with their short time scale suggest some form of flare-like or shock origin for the phenomenon. Author

N75-11809*# Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
HELIUM EMISSION IN THE SPECTRUM OF KAPPA CANIS MAJORIS
J. D. R. Bahng and Elaine Hendry 26 Aug. 1974 6 p refs
(Contract NGR-14-007-122)
(NASA-CR-140657) Avail: NTIS HC $3.25 CSCL 03A

Coude spectra of kappa CMa in the red region showed H alpha and He 1 lambda lambda 5876,6678 in emission. Each of the lines had two emission components, but the helium lines had no detectable absorption feature in between. While the H alpha emission peaks were separated by 160 km/sec, the helium lines were separated by 400 km/sec. A simple model is proposed to account for the behavior of these emission lines. Author

N75-11810*# Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
PHOTOELECTRIC SPECTROPHOTOMETRY OF WOLF-RAYET STARS
J. D. R. Bahng [1974] 15 p refs
(Grant NGR-14-007-122)
(NASA-CR-140743) Avail: NTIS HC $3.25 CSCL 03A

Photoelectric spectrum scans of five southern Wolf-Rayet stars in the spectral range lambda lambda 4600-4720 were analyzed to study the variability of brightness and of emission line strengths. No variations of any kind in short time scale were found. However, in WC stars night-to-night variations of

three to four percent were detected in the emission line strengths. Author

N75-11811# Army Foreign Science and Technology Center, Charlottesville, Va.
PROBLEMS OF ASTRONOMY AND GEODESY DISCUSSED AT THE PLENUM OF THE CENTRAL COUNCIL OF UAGS
A. V. Butkevich, E. B. Gromov, and L. S. Khrenov 9 Feb. 1974 13 p ref Transl. into ENGLISH from Geod. i Kartografiya (USSR), no. 7, 1972 p 60-63 Conf. held at Baku, 15-18 Mar. 1972 (AD-784749; FSTC-HT-23-1562-73) Avail: NTIS CSCL 03/1

This article discusses the papers read, discussions held, and resolutions made at the plenary session of the Central Council of the All-Union Astronomical and Geodesic Society. Topics include: seismic disturbance which has caused settling in Azerbaidjan; the construction of a subway in Baku; increased educational facilities for geodesic study; plans to build planetariums and observatories; and astronomical observations at Shemahinsky observatory. GRA

N75-10990* Kanner (Leo) Associates, Redwood City, Calif.
LOW NOISE PARAMETRIC AMPLIFIERS FOR RADIO ASTRONOMY OBSERVATIONS AT 18-21 cm WAVELENGTH
B. Z. Kanevskiy, V. M. Veselov, I. A. Strukov, and V. S. Etkin *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 23-27 Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 16-18 (For availability see N75-10988 02-18)
CSCL 03A

N75-11010* Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF THE EFFECTIVENESS OF A GAMMA TELESCOPE
Yu. A. Rylov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 319-334 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 210-218 (For availability see N75-10988 02-18)
CSCL 17H

N75-11281* Defense Mapping Agency Topographic Center, Washington, D.C.
THE AUTOMATED ASTRONOMIC POSITIONING SYSTEM (AAPS)
Owen N. Williams *In* NASA. Goddard Space Flight Center Proc. of the 5th Ann. NASA and DOD Precise Time and Time Interval Planning Meeting 1973 p 75-93 (For availability see N75-11275 02-35)
CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N75-11812*# Techtran Corp., Glen Burnie, Md.
OUTER SPACE AND CRUSTAL MOVEMENTS
A. Ye. Mikhaylov Washington NASA Nov. 1974 25 p refs Transl. into ENGLISH from Priroda (USSR), no. 8, Aug. 1973 p 20-29
(Contract NASw-2485)
(NASA-TT-F-15954) Avail: NTIS HC $3.25 CSCL 03B

An explanation is presented of tectonic movements which considers the internal energy of the earth, and outer space factors. It is shown that outer space phenomena affect terrestrial geological processes. Author

N75-11813# Oslo Univ. (Norway). Inst. for Theoretical Astrophysics.
MAGNETIC ACCRETION PROCESSES AND ATMOSPHERIC PECULIARITIES IN MAGNETIC STARS AND THE ROLE OF THESE STARS AS COSMIC RAY SOURCES

stars is first presented qualitatively and then treated quantitatively. It was found that atoms and ions from interstellar gas may enter the stellar magnetosphere driven by the electromagnetic field of the rotating magnetosphere or by the star's gravitational field, and become trapped. The particles then diffuse out of the particle belts and down to the stellar surface, which gradually changes its composition toward that of the particle belts. The particles descend preferentially near the magnetic poles and form abundance spots there. Ions not trapped are likely to leave the magnetosphere with a large increase in velocity, the magnetosphere and its magnetic field acting like a magnetic mirror, and large cosmicray velocities being obtained by the ions. The required energy input from cosmic rays in the Galaxy is such that cosmic rays from magnetic stars can account for, at the most, 10% of this energy. NSA

N75-11428* Scientific Translation Service, Santa Barbara, Calif.
APPLICABILITY OF THE DIFFUSION APPROXIMATION
Yu. L. Biryukov, L. G. Titarchuk, and Yu. M. Chesnokov *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 75-84 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 63-70 (For availability see N75-11419 02-43)
CSCL 03B

N75-11430* Scientific Translation Service, Santa Barbara, Calif.
ESTIMATES OF THE VENUS ATMOSPHERE OPTICAL CHARACTERISTICS WITH APPLICATION TO THE PROBLEM OF PHOTOGRAPHING ITS CLOUDS AND SURFACE
Yu. L. Biryukov, A. S. Fanfilov, and L. G. Titarchuk *In its* Space Iconics (NASA-TT-F-798) Sep. 1974 p 121-135 refs Transl. into ENGLISH of the publ. "Kosmicheskaya Ikonika" Moscow, Nauka Press, 1973 p 106-117 (For availability see N75-11419 02-43)
CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N75-11814*# Kanner (Leo) Associates, Redwood City, Calif.
LUNAR SOIL FROM THE SEA OF FERTILITY
A. P. Vinogradov, ed. Washington NASA Oct. 1974 642 p refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 Original contains color illustrations
(Contract NASw-2481)
(NASA-TT-F-15881) Avail: NTIS HC $15.25 CSCL 03B

Physical, mechanical, and biological activity studies on lunar surface material from the Sea of Fertility returned by the Soviet Lunik 16 lunar probe. For individual titles, see N75-11815 through N75-11877.

N75-11815* Kanner (Leo) Associates, Redwood City, Calif.
PRELIMINARY DATA ON LUNAR SURFACE MATERIAL RETURNED BY LUNA 16 AUTOMATIC STATION
A. P. Vinogradov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 1-18 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 7-18 Original contains color illustrations (For availability see N75-11814 02-91)
CSCL 03B

Results of preliminary investigations of a sample of lunar surface material returned by Luna 16 automatic station are reported. Information on the granulometric characteristics of regolith, its optical properties, types of its constituent rocks, and

inert gases and of several elements was studied. The Rb/Sr age was determined at 4.85 to 4.25 billion years. Author

N75-11816* Kanner (Leo) Associates, Redwood City, Calif.
GEOLOGO-MORPHOLOGICAL CHARACTERISTICS OF THE LANDING SITE OF LUNA 16 AUTOMATIC STATION
K. P. Florenskiy, A. T. Bazilevskiy, and A. A. Pronin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 19-26 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 19-28 (For availability see N75-11814 02-91)
CSCL 03B

A brief geological outline of the landing site of Luna 16 automatic lunar station is presented that includes data on the strucutral features, estimates of thickness, and stratigraphic positions of the lava infilling of the Sea of Fertility. Determinations are made of the relative duration of surface formation near the landing site based on data of the statistical counts of crater distribution. Descriptions and several morphometric characteristics of noncrater forms of relief complicating the surface of the Sea of Fertility are given. Possible sources of the regolith material returned by Luna 16 are examined. Author

N75-11817* Kanner (Leo) Associates, Redwood City, Calif.
RECEPTION AND STUDY OF LUNAR SURFACE MATERIAL IN INERT GAS MEDIUM
Yu. A. Surkov, Ye. M. Rudnitskiy, and V. A. Glotov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 27-33 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 29-33 (For availability see N75-11814 02-91)
CSCL 03B

The reception and study of lunar material returned by the Luna 16 space station is described. The layout of a vacuum receiving chamber for working with material in a helium atmosphere is examined along with the main operations involved in extracting the material from the ampule and drill. Author

N75-11818* Kanner (Leo) Associates, Redwood City, Calif.
BOX FOR WORKING WITH LUNAR SAMPLES IN NITROGEN ATMOSPHERE
Yu. I. Stakhyev, L. S. Tarasov, K. K. Krestinina, and A. V. Ivanov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 34-39 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 34-37 (For availability see N75-11814 02-91)
CSCL 03B

The design and equipment of a box specially built for working with lunar surface material is described. The box is intended for preliminary investigations, packing of samples, and carrying out a large number of operations necessary for this stage in the study of samples. Author

N75-11819* Kanner (Leo) Associates, Redwood City, Calif.
MORPHOLOGY AND TYPES OF PARTICLES OF REGOLITH SAMPLE FROM THE SEA OF FERTILITY
K. P. Florenskiy, A. V. Ivanov, L. S. Tarasov, Yu. I. Stakhyev, and O. D. Rode *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 40-50 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 38-43 (For availability see N75-11814 02-91)
CSCL 03B

A brief description of the morphology of lunar surface material returned by Luna 16 automatic lunar station is given. Adhesiveness of the surface material and its ability to be electrified is noted. Two main genetic groups of regolith particles are differentiated: primary, represented mainly by fragments of magmatic rocks of the basalt and gabbro types, as well as mineralized grains of their constituent minerals, and secondary, particles subjected to appreciable exogenic transformation on the surface of the Moon. The second group, representing more than 70 percent of the material in coarse fractions, includes particles of breccias, sintered aggregates of complex dendritic form, and glass and vitrified particles of varied composition. Author

N75-11820* Kanner (Leo) Associates, Redwood City, Calif.
GRANULOMETRIC CHARACTERISTICS OF LUNAR SURFACE MATERIAL FROM THE SEA OF FERTILITY
Yu. I. Stakheyev, Ye. K. Vulfson, A. V. Ivanov, and K. P. Florenskiy *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 51-60 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 44-49 (For availability see N75-11814 02-91)
CSCL 03B

The particle size distributions in the 1-1000 micrometer range along the length of the core of lunar surface material returned by Luna 16 were recorded by electrical impulse as well as sieve methods. The measurements are represented in the form of cumulative functions of the logarithm of size versus the logarithm of particle number, and also as the logarithm of size versus particle mass on a probability scale. The former functions at all depths consist of the super-positioning of two straight lines with slopes from 2.10 to 4.05. The second functions are near linear, which together with the closeness of the calculated asymmetries of the distribution to zero and the nearness of the calculated excess of the distributions to unity indicate the closeness of the recorded distributions to the logarithmically normal law. This agrees with the assumption that regolith particles were formed in a process of intensive mechanical grinding. Author

N75-11821* Kanner (Leo) Associates, Redwood City, Calif.
MORPHOMETRIC CHARACTERISTICS OF PARTICLES OF REGOLITH RETURNED BY LUNA 16 AUTOMATIC STATION
P. V. Florenskiy, V. Ya. Belenkiy, N. M. Karachentseva, and L. F. Pankratova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 61-68 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 50-53 (For availability see N75-11814 02-91)
CSCL 03B

A study was made of the shape of regolith particles in the 0.5 to 1.0 mm fraction; two parameters were calculated for this fraction: (1) Sphericity -- the ratio of the projection area of a particle to the area of the minimum circumscribed circle; and (2) the ratio of the perimeter of the projection of the particle to the perimeter of a circle having the same width. For comparison, this technique was used in studying geometrical figures and terrestrial formations: sands, slags of present day volcanoes, and crushed basalt. It was established that regolith particles are shaped from the following groups: spherules; breccias and fragments; slags and sinters. Regolith differs sharply from ordinary homogeneous terrestrial formations in the diversity of particle shapes, associated with their polygenicity. Fragments of crushed basalt are less regular than fragments of basalt from regolith. Author

N75-11822* Kanner (Leo) Associates, Redwood City, Calif.
MEASUREMENT OF DENSITY AND POROSITY OF LUNAR ROCKS BASED ON SAMPLES OF LUNA 16 AUTOMATIC LUNAR STATION
V. F. Volynets, K. P. Florenskiy, and A. V. Ivanov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 69-73 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 54-55 (For availability see N75-11814 02-91)
CSCL 03B

Three fragments of holocrystalline igneous rocks of the gabbro type, weighing 30 to 50 mg each, were investigated. The density of the fragments was established with a mercury pycnometer and was found to be 3.05 to 3.12 g/cu cm, with a relative error not more than 2 percent. The porosity was found for the difference between the volumes determined with the mercury and with the gas techniques; for all three samples together it was 13 percent, and the error of determination was 70 percent owing to the small volumes. It can be anticipated that the porosity of the rock in bulk will be higher than the value obtained based on small fragments. The porosity of lunar rocks can markedly affect the isostatic distribution of rocks and must be taken into account when developing models of lunar structure. Author

N75-11823* Kanner (Leo) Associates, Redwood City, Calif.
PETROLOGY OF LUNAR ROCKS FROM THE SEA OF FERTILITY
A. S. Pavlenko, L. S. Tarasov, I. D. Shevaleyevskiy, and A. V.

Ivanov *In its* Lunar Soil From the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 74-85 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 56-105 (For availability see N75-11814 02-91)
CSCL 03B

Based on a comparative analysis of the petrochemistry of an integrated sample of gabbro basalts and a fine fraction from regolith returned by Luna 16 automatic station from the Sea of Fertility, with the mean compositions of various types of mare basalts, anorthosites, and regolith from the Sea of Tranquillity and the Ocean of Storms, with reference to several data on rare elements, the nature of the fine fractions is discussed. It is shown that the integrated sample of gabbro basalt from the coarse fraction in the lower part of the core can be represented as a mixture of mare basalts of the Sea of Tranquillity and nonmare basalts of the krip type in the ratio of about 3 to 2. It is confirmed that the compositions of the Apollo 11 and Apollo 12 regolith are complementary with the compositions of basalts and anorthosites of the Sea of Tranquillity and the Ocean of Storms. Author

N75-11824* Kanner (Leo) Associates, Redwood City, Calif.
PRELIMINARY REPORT OF MINERALOGICAL AND PETROGRAPHIC STUDY OF THE LUNA 16 LUNAR SURFACE MATERIAL SAMPLE
M. Christophe-Michel-Levi, C. Levi, and P. Pierreault *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 86-93 ref Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 106-128 (For availability see N75-11814 02-91)
CSCL 03B

Unsorted powder and grains larger than 0.5 mm from the L-16-19-118 lunar sample consisted of eight basaltic fragments, four fragments of breccias (of which one was quite light), one white grain (maskelynite), one chondrule, and slagged dark partially glassy chunks. The mineralogical composition of all rounded particles led to the assumption that they are all of lunar origin; but their presence in the regolith indicates formation of chondrulic meteorites. The existence of several grains of pyroxene coated with a thin glassy film merits attention. G.G.

N75-11825* Kanner (Leo) Associates, Redwood City, Calif.
PETROGRAPHIC-MINERALOGICAL INVESTIGATION OF MAGMATIC ROCKS FROM THE SEA OF FERTILITY
L. S. Tarasov, I. D. Shevaleyevskiy, and M. A. Nazarov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 94-120 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 129-147 (For availability see N75-11814 02-91)
CSCL 03B

Petrographic and mineralogical features of fragments of magmatic rock of regolith from the Sea of Fertility are examined. The textures and mineral composition vary in relation to the type of rock. More than 50 X-ray spectral analyses of minerals (olivine, pyroxenes, plagioclases, and ores) were made; their chemical composition varies even within the limits of individual rock fragments. Author

N75-11826* Kanner (Leo) Associates, Redwood City, Calif.
X-RAY DIFFRACTION IDENTIFICATION OF MINERALS IN LUNAR REGOLITH RETURNED BY LUNA 16 AUTOMATIC STATION
Ye. S. Makarov, V. I. Ivanov, V. I. Mokeyeva, K. I. Tobelko, V. I. Bukin, A. Ya. Volkova, G. A. Kuznetsova, and L. M. Kuznetsov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 121-144 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 148-208 (For availability see N75-11814 02-91)
CSCL 03B

The methods of powder and monocrystal X-ray diffraction served in identifying the mineral composition of gross samples of regolith from different levels of the drill core and about 80 individual regolith particles returned by the Luna 16 station. It was established that the Sea of Fertility regolith includes pyroxenes of the augite-pigeonite series, anorthites, ilmenite, olivines, spinels, alpha cristobalite, iron particles, glass, and several as yet unidentified particles. Crystallographic and roentgenometric data are given for all the lunar minerals found. Author

N75-11827* Kanner (Leo) Associates, Redwood City, Calif.
X-RAY SPECTRAL MICROANALYSIS OF COMPOSITION OF INDIVIDUAL LUNAR REGOLITH PARTICLES
N. P. Ilin, L. Ye. Loseva, and V. G. Senin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 145-154 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 209-224 (For availability see N75-11814 02-91)
CSCL 03B

Determinations were made of the chemical compositions of selected olivine crystals, spherical particles ranging in size from 170 to 350 micrometer, spinels, and magnetic particles. The olivines contain 30 to 50 mole percent fayalite. The spherical particles of various colors are aluminosilicate glasses, significantly enriched in CaO compared with the mean composition of the regolith. The degree of coloration depends on the FeO content and also the admixtures TiO2, MnO, and Cr2O3. Compositionally, the spinel was interpreted to be chromopicotites. Magnetic particles were shown to be complex intergrowths of nickelous iron and aluminosilicates. The composition of the metallic phase of one particle (in percent) was: Fe - 86, Ni - 13.6, and Co - 0.16 in combination with plagioclase and microinclusions of ilmenite in silicate. Kamacite was determined in another intergrowth of Fe, Ni, and Co. Author

N75-11828* Kanner (Leo) Associates, Redwood City, Calif.
SCANNING ELECTRON MICROSCOPY OF LUNAR REGOLITH FROM THE SEA OF FERTILITY
M. K. Antoshin, N. P. Ilin, and G. V. Spivak *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 155-165 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 225-231 (For availability see N75-11814 02-91)
CSCL 03B

Scanning electron microscopy was used in studying the morphology and cathodoluminescence of lunar regolith particles. Surface and structure of two groups of particles are differentiated: (1) Crystalline with well defined facets and spalling surfaces, which are grains of minerals and rock fragments: and (2) amorphous, fused, and partially or entirely glazed particles. Local melting of particles and the round openings on their surfaces are attributed to secondary influence on the regolith of factors of lunar weathering and above all micrometeoric impacts.
Author

N75-11829* Kanner (Leo) Associates, Redwood City, Calif.
SILICATE SPHERULES IN SAMPLE OF REGOLITH RETURNED BY LUNAR 16 AUTOMATIC STATION
A. V. Ivanov, O. D. Roda, Yu. I. Stakheyev, and K. P. Florenskiy *In its* Lunar Soil from the Sea of Fertilty (NAASA-TT-F-15881) Oct. 1974 p 166-173 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 232-235 (For availability see N75-11814 02-91)
CSCL 03B

The content of spherical fused particles in Sea of Fertility regolith increases with decrease in particle size and varies from 1 to 2 percent in the relatively coarse fractions to 3 to 4 percent in the fine fractions. Among the spherical formations was noted a wide diversity of shapes, and the most common are particles that are similar in shape to a regular sphere, which indicates the acquisition of shape in the liquid phase under the action of surface tension. As to color, the most common are the black and dark colored particles. No regularities of any kind were noted in the distribution of spherical particles by core zones. The considerable difference of the granulometric characteristics of the spherical particles and the regolith as a whole indicates that the formation of regolith particles and the spherules included in its composition occurred as the result of different, even though possibly simultaneous, processes. Author

N75-11830* Kanner (Leo) Associates, Redwood City, Calif.
X-RAY STRUCTURAL STUDY OF CHROME-ALUMINUM LUNAR SPINEL FROM THE SEA OF FERTILITY
Yu. Z. Nozik and A. B. Tovbis *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 174-178 refs

Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 262-263 (For availability see N75-11814 02-91)
CSCL 03B

An X-ray structural study was made of a lunar spinel sample from the Sea of Fertility. The chemical composition and distribution of cations in the structure were characterized. Interpretation of the experimental data by the least squares method yielded the oxygen parameter u = 0.261 and the isotropic temperature factor 1.09 AU squared. Author

N75-11831* Kanner (Leo) Associates, Redwood City, Calif.
CHEMICAL COMPOSITION OF LUNA 16 LUNAR REGOLITH
A. P. Vinogradov, M. S. Chupakhin, and Yu. I. Belyayev *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 179-201 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 264-277 (For availability see N75-11814 02-91)
CSCL 03B

Data on the chemical composition of regolith returned by the Luna 16 automatic station and two fragments of basalts from the lower layer of the core are presented. Spark mass spectrometric, primary X-ray spectral, emission spectral, and atomic absorption methods were used in the analysis. The regolith of mare provinces were shown to be a mixture of material of various origins. The source of the material of the mare regolith was principally basalts of the corresponding lunar lava maria. The regolith is genetically related to it. This follows from a comparison of the chemical composition, mineralogical, and petrochemical features of the basesalts and the regolith from the Sea of Fertility, Sea of Tranquillity, and Ocean of Storms, respectively. Author

N75-11832* Kanner (Leo) Associates, Redwood City, Calif.
NEUTRON ACTIVATION STUDY OF THE COMPOSITION OF LUNAR SURFACE MATERIAL FROM THE SEA OF FERTILITY
Yu. A. Surkov, F. F. Kirnozov, I. N. Ivanov, G. M. Kilesov, B. N. Ryvkin, and A. P. Shpanov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 202-208 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 283-286 (For availability see N75-11814 02-91)
CSCL 03B

The elemental composition of samples of lunar regolith returned by Luna 16 from the Sea of Fertility was determined by a radio activation method using generator and reactor neutrons, and also by gamma spectrometry with scintillation and Ge(Li) detectors. Author

N75-11833* Kanner (Leo) Associates, Redwood City, Calif.
NONDESTRUCTIVE ACTIVATION ANALYSIS OF SAMPLE OF LUNAR SURFACE MATERIAL RETURNED BY LUNA 16 AUTOMATIC STATION
M. Chayko and E. Sabo *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 209-213 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 287-289 (For availability see N75-11814 02-91)
CSCL 03B

The composition of a sample of lunar surface material returned by the Luna 16 automatic station from the Sea of Fertility was studied, using nondestructive activation analysis. The structure of the returned surface material is inhomogeneous; the surficial material is thin, quite homogeneous, and the granularity increases with depth. Based on grain size, the sample was separated into five zones. The activation analysis was conducted on a sample taken from the friable surficial layer, zone A. The content of Al, Mn, Na, Cr, Co, Fe, and Sc was determined by nondestructive activation analysis of the sample. In determining Cr, Co, Fe, and Sc, the sample was irradiated for 24 hours and cooled for 10 days. Gamma spectra of the samples were recorded with a semiconductor Ge(Li)-detector and a multichannel analyzer, and measurement data were processed with an electronic computer. Author

N75-11834* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF RARE-EARTH ELEMENTS IN LUNA 16 REGOLITH SAMPLE BY CHEMICAL SPECTRAL METHOD
N. S. Stroganova, V. A. Ryabukhin, N. V. Laktinova, L. V. Ageyeva, I. P. Galkina, N. G. Gatinskaya, A. N. Yermakov, and A. V. Karyakin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 214-219 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 294-296 (For availability see N75-11814 02-91)
CSCL 03B

An analysis was made of regolith from layer A of the Luna 16 sample for rare earth elements, by a chemical spectral method. Chemical and ion exchange concentrations were used to determine the content of 12 elements and Y at the level 0.001 to 0.0001 percent with 10 to 15 percent reproducibility of the emission determination. Results within the limits of reproducibility agree with data obtained by mass spectra, activation, and X-ray fluorescent methods. Author

N75-11835* Kanner (Leo) Associates, Redwood City, Calif.
ROCK-FORMING AND RARE ELEMENTS IN LUNAR SURFACE MATERIAL FROM THE SEA OF TRANQUILLITY AND THE OCEAN OF STORMS
I. D. Shevaleyevskiy and M. S. Chupakhin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 220-223 ref Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 297-298 (For availability see N75-11814 02-91)
CSCL 03B

Methodological and analytical capabilities associated with spark mass spectrometry and X-ray spectroscopy are presented for the determination of the elemental composition of samples of lunar regolith returned to the earth by Apollo 11 and Apollo 12. Using X-ray spectroscopy, the main constituents of samples of lunar surface material were determined, and using mass spectrometry -- the main admixtures. The principal difference of Apollo 11 samples from Apollo 12 samples was found for elements contained in microconcentrations. This is especially true of rare earth elements. Author

N75-11836* Kanner (Leo) Associates, Redwood City, Calif.
X-RAY ELECTRON STUDY OF LUNAR REGOLITH FROM THE SEA OF FERTILITY AND THE SEA OF TRANQUILLITY
A. P. Vinogradov, V. I. Nefedov, V. S. Urusov, and N. M. Zhavoronkov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 224-231 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow Nauka Press, 1974 p 319-322 (For availability see N75-11814 02-91)
CSCL 03B

X-ray electron spectra were obtained of the 2p-levels of Fe, Ti, Si, Al, and Mg, and of the 1s-level in lunar regolith from the Sea of Fertility and the Sea of Tranquillity. The spectra of the same elements were recorded for approximately 30 rock forming minerals, oceanic gabbro, meteoritic eucrite, and several iron meteorites. Analysis of the results based on line positions showed that all the elements studied have the usual degrees of oxidation, and that oxygen atoms are their nearest neighbors. The predominant coordination number of Al is 4. Analysis and comparison of the Fe2p spectra in regolith, various iron meteorites, and stainless steel leads to these conclusions: Metallic iron in lunar regolith is in a highly dispersed state and is unusually stable with respect to oxidation by the oxygen of the earth's atmosphere. Author

N75-11837* Kanner (Leo) Associates, Redwood City, Calif.
ELECTRON PARAMAGNETIC RESONANCE OF SEVERAL LUNAR ROCK SAMPLES
P. N. Marov, Yu. N. Dubrov, and A. N. Yermakov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 232-237 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 323-325 (For availability see N75-11814 02-91)
CSCL 03B

The results are presented of investigating lunar rock samples

returned by the Luna 16 automatic station, using electron paramagnetic resonance (EPR). The EPR technique makes it possible to detect paramagnetic centers and investigate their nature, with high sensitivity. Regolith (finely dispersed material) and five particles from it, 0.3 mm in size, consisting mostly of olivine, were investigated with EPR. Author

N75-11838* Kanner (Leo) Associates, Redwood City, Calif.
MOSSBAUER SPECTROSCOPIC STUDY OF LUNA 16 LUNAR REGOLITH
T. V. Malysheva *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 238-249 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 326-333 (For availability see N75-11814 02-91)
CSCL 03B

Samples of bulk fractions of lunar regolith from the surface layer A and the deep layer V were measured by Mossbauer spectroscopy with the FE57 nucleus. Metallic iron, ilmenite, olivine, pyroxene (mainly augite), and glasses were found. The iron distribution by mineral phases indicates that Luna 16 regolith differs from Apollo 11 regolith by a lower ilmenite content and a greater amount of olivine, and differs from Apollo 12 regolith by somewhat more olivine. No appreciable amount of iron was found in the trivalent state. Author

N75-11839* Kanner (Leo) Associates, Redwood City, Calif.
MOSSBAUER ANALYSIS OF LUNA 16 LUNAR SURFACE MATERIAL
D. L Nady, L. Cher, and K. Kulcsar *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 250-252 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 334 (For availability see N75-11814 02-91)
CSCL 03B

Samples of Apollo 11 lunar surface material were studied by the Mossbauer effect. Owing to the small number of other resonant isotopes, all measurements were made with Fe-57 nuclei. The principal constituents of the material were as follows: Iron containing silicates (olivine, pyroxene, and so on), ilmenite (FeTiO3), and metallic iron. Author

N75-11840* Kanner (Leo) Associates, Redwood City, Calif.
ABUNDANCE OF MERCURY IN REGOLITH OF THE SEA OF FERTILITY, SEA OF TRANQUILLITY, AND OCEAN OF STORMS
Yu. I. Belyayev and T. A. Koveshnikova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 253-259 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 335-338 (For availability see N75-11814 02-91)
CSCL 03B

The direct determination of mercury by the atomic fluorescent method is described, involving the pulsed thermal atomization of powdered samples when the mercury is vaporized in argon at normal pressure. An increase in the mercury abundance in the regolith of the surficial layer with decrease in grain size and with variation in depth was noted, from 6 minus 1 million the surficial layer to 9 minus 1 million percent at a depth of about 30 cm. It is shown that in conditions simulating lunar day, at temperatures of 130-150 C up to 15 to 20 percent of the mercury is vaporized from a 2 mg regolith weighed sample, and thus the hypothesis is advanced that mercury is adsorbed by the surface layers of the lunar surface material during lunar night and desorbed during lunar day. The assumption is advanced that there exists a meridional mercury wind between subsolar region of the moon (heater) and the polar regions (cooler).
Author

N75-11841* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF COPPER, SCANDIUM, MOLYBDENUM, TIN, LEAD, AND IRON GROUP ELEMENTS IN LUNAR SURFACE MATERIALS
L I. Pavlenko, L V. Simonova, and A. V. Karyakin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 260-268 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 339-343 (For availability see N75-11814 02-91)
CSCL 03B

Distribution regularities of copper, scandium, molybdenum, tin, lead, and iron group elements were investigated in basaltoid rocks of lunar and terrestrial origin. Samples of various regolith zones taken in the area of the Sea of Fertility were analyzed, along with samples of basic and ultrabasic rocks of the East African Rift for their content of the trace admixtures listed. Data obtained on the abundance of copper, scandium, molybdenum, tin, lead, cobalt, nickel, chromium, and vanadium in Luna 16 lunar surface material were compared with the abundance of these elements in samples of lunar rocks returned by Apollo 11, Apollo 12, and Apollo 14, with the exception of scandium; its content in the latter samples was considerably higher.
Author

N75-11842* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF VOLATILE ANIONS: PHOSPHORUS, SULFUR, FLUORINE, AND ALSO BERYLLIUM AND BORON IN LUNAR REGOLITH BY EMISSION SPECTRAL ANALYSIS
Ye. N. Savinova, A. V. Karyakin, and T. P. Andreyeva *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 269-276 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 344-347 (For availability see N75-11814 02-91)
CSCL 03B

Processes occurring in the arc discharge and in the plasma jet were used for direct spectral determination of the following anions: Phosphorus, sulfur, fluorine as well as beryllium and boron in lunar surface material. The excitation source was a plasmotron with consumable electrodes. The plasma forming gas was helium. The weighed sample for a single determination was 10 mg. The detectability was: P -- 2.5X0.001, S -- 5.0x0.01, F -- 2.5x0.001, Be -- 5.0x0.00001, and B -- 2.5x0.0001. The coefficient of variation for a single determination of phosphorus, sulfur, fluorine, beryllium, and boron was 5 to 10 percent.
Author

N75-11843* Kanner (Leo) Associates, Redwood City, Calif.
GENESIS OF LUNAR REGOLITH
A. P. Vinogradov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 277-292 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 348-355 (For availability see N75-11814 02-91)
CSCL 03B

From comparing the mineral and chemical composition of regoliths with the compositions of primary magmatic lunar rocks, it is shown that mare regolith is enriched in aluminum and depleted in iron, titanium, and chromium. This effect cannot be accounted for only by the admixture of highland anorthositic material. The entire array of geochemical data points to the considerable role of depth-wise differentiation of the magmatic material in forming the composition of the primary lunar rocks and, naturally, the composition of the regolith. During regolith formation, processes of the effervescing of magma as it outflowed at the lunar surface were of primary importance. Impacts by micrometeorites represent another important factor. Author

N75-11844* Kanner (Leo) Associates, Redwood City, Calif.
RESULTS OF INVESTIGATING GASES FROM INCLUSIONS IN LUNAR GLASSES
Yu. A. Dolgov and N. A. Shugurova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 293-305 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 356-362 (For availability see N75-11814 02-91)
CSCL 03B

Common gases from inclusions in glass fragments and spherules of lunar surface material returned by the Luna 16 automatic station were investigated by the adsorption volumometric method. Inclusions from eight particles were analyzed. A gas mixture from the inclusions had two- (CO_2 and H_2), three- (CO_2, H_2 and N_2 + inert gases), and (H_2S, SO_2, and NH_3), H_2,N_2 + inert gases, and four component (H_2S, SO_2, and NH_3), CO_2, H_2, and N_2 + inert gases, compositions. Hydrogen in all analyses was 10 to 95 volume percent. Diffusional exchange with the terrestrial atmosphere was absent. An unexpectedly

high density of gases in the vacuoles was obtained. The initial volume of the bubbles when the vacuoles were breached even rose 2.5 times and decreased in the limits of 2.3 to 54.5 times. Various possibilities for the formation in the lunar surface material of glass fragments and spherules are discussed. Author

N75-11845* Kanner (Leo) Associates, Redwood City, Calif.
ISOTOPIC COMPOSITION OF LITHIUM, POTASSIUM, RUBIDIUM, AND STRONTIUM IN LUNAR SURFACE MATERIAL
V. G. Zaslavskiy, L. K. Levskiy, and A. N. Murin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 306-310 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 363-364 (For availability see N75-11814 02-91)
CSCL 03B

The isotopic composition of alkali and alkaline earth elements in the Luna 16 regolith was investigated by the method of thermionic emission, without chemical separation. The isotopic composition of the lithium in two regolith samples did not differ (wathin the limits 0.5 percent) from the mean of the terrestrial reference standard. At the same time, the observed difference (1 percent) in the isotopic composition of lithium between the samples requires further investigation and confirmation. The isotopic compositions of K and Rb did not differ within the limits of experimental error from the isotopic composition of the reference standard. Author

N75-11846* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF ISOTOPIC COMPOSITION OF HELIUM IN THE FINE FRACTION OF LUNA 16 LUNAR SURFACE MATERIAL
B. S. Boltenkov, V. N. Gartmanov, E. I. Ilyasov, G. Ye. Kocharov, B. A. Mamyrin, Yu. A. Surkov, and L. V. Khabarin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 311-319 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 365-369 (For availability see N75-11814 02-91)
CSCL 03B

The content of He isotopes is measured in two samples of the lunar surface material returned by the Luna 16 automatic station. Both samples consist of a fine fraction of lunar surface material and were samples from zone A (sample 3-2k) and from zone V (sample 9-1r). The value of He4/He3 and the concentration of the He isotopes are identical for both samples, within the limits of experimental error. Author

N75-11847* Kanner (Leo) Associates, Redwood City, Calif.
CONTENT OF LITHIUM, BERYLLIUM, BORON, AND TITANIUM, AND THE ISOTOPIC COMPOSITION OF LITHIUM, BORON, AND MAGNESIUM IN LUNA 16 REGOLITH SAMPLE
O. Eugster *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 320-329 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 370-374 (For availability see N75-11814 02-91)

The abundance of the following elements in the L 16-19 No. 118 regolith sample, zone V was determined by isotopic dilution using a mass spectrometer equipped with a scattering ion source: Li -- 9.8, Be -- 1.2, Be -- 2.6, and Ti -- 1.92 percent. For comparison, these same elements were measured in samples of surface material returned by Apollo 11, Apollo 12, and Apollo 14, and in the terrestrial reference standard diabase W-1. The content of Li, Be, and B in the Luna 16 sample is nearly the same as in the Apollo 11 surface material. The surface material returned by Apollo 12 and Apollo 14 contains two to four times more of these elements. However, the abundance ratios of Li, Be, and B are remarkably similar in the surface materials from the four different lunar regions. With respect to basaltic achondrites and especially with respect to chondrites, the lunar basalts are enriched in Li, Be, and B up to 100 times. Author

N75-11848* Kanner (Leo) Associates, Redwood City, Calif.
NEUTRON ACTIVATION DETERMINATION OF THE OXYGEN CONTENT IN THE LUNA 16 LUNAR SURFACE MATERIAL
A. Nady, A. Chekke, E. Sabo, B. Forsag, and E. Zemplen *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 330-338 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 377-378 (For availability see N75-11814 02-91)
CSCL 03B

The O2 content in the No. 16/078 sample of lunar surface material returned by the Luna 16 automatic station was determined by activation using 14 MeV neutrons. The O2 content in the sample is 42.1 + or - 1.2 weight percent. Author

N75-11849* Kanner (Leo) Associates, Redwood City, Calif.
INERT GASES IN SEA OF FERTILITY REGOLITH
A. P. Vinogradov and I. K. Zadorozhnyy *In its* Lunar Soil From the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 334-347 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 379-404 (For availability see N75-11814 02-91)
CSCL 03B

The content and isotopic composition were studied of inert gases -- He, Ne, Ar, Kr, and Xe -- in samples of lunar regolith returned by the Luna 16 automatic station. The samples were taken from depths of about 12 and 30 cm. The high concentrations of inert gases exceed by several orders their concentrations observed in ordinary stony meteorites. The gases in lunar regolith were a complex mixture of gases of different origins: Solar, cosmogenic, radiogenic, and so on. Solar wind gases predominated, distributed in the thin surficial layer of the regolith grains. The concentrations of these gases in the surficial layer is several cubic centimeters per gram. The isotopic composition of the inert gases of solar origin approaches their composition measured in gas-rich meteorites. Author

N75-11850* Kanner (Leo) Associates, Redwood City, Calif.
PROBLEM OF NATURE OF INERT GASES IN LUNAR SURFACE MATERIAL
L. K. Levskiy *In its* Lunar soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 348-357 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 405-409 (For availability see N75-11814 02-91)
CSCL 03B

The origin of isotopes of inert gases in lunar surface material was investigated from the standpoint of the isotopic two-component status of inert gases in the solar system. Helium and neon represent the solar wind component, while krypton and xenon are planetary gases. Type A gases are trapped by the material of the regolith in the early stages of the existence of the solar system and were brought to the lunar surface together with dust. The material of the regolith therefore cannot be considered as the product of the erosion of the crystalline rocks of the moon and in this sense are extralunar. The regolith material containing type A gases must be identified with the high temperature minerals of the carbonaceous chondrites. Author

N75-11851* Kanner (Leo) Associates, Redwood City, Calif.
COSMOGENIC Al-26 AND Na-22 IN LUNA-16 LUNAR REGOLITH
A. P. Vinogradov, A. K. Lavrukhina, V. D. Gorin, and G. K. Ustinova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 358-369 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 410-416 (For availability see N75-11814 02-91)
CSCL 03B

The activities of cosmogenic isotopes Al-26 and Na-22 in two samples taken from different depths of the lunar regolith core returned by the Luna 16 automatic station were measured by scintillation gamma spectrometer. The measured activities, when recalculated to the time of sampling of the lunar surface material, are: Al-26 - 62 + or - 8 and 54 + or - 9; Na-22 - 42 + or - 8 and 48 + or - 9. Depthwise distributions of the activities of these isotopes in lunar rocks of different types indicate the presence of a considerable depth gradient of activity near the surface caused by the fall off in the fluxes of primary and secondary cosmic radiation. The absence of this gradient in the measured samples, along with data on the tracks and content of inert gases, as well as the granulometric characteristics of

the regolith indicate that the surficial layer of the regolith at the sampling site underwent mixing. Author

N75-11852* Kanner (Leo) Associates, Redwood City, Calif.
GAMMA-SPECTROMETRIC ANALYSIS OF LUNA 16 SAMPLE OF LUNAR SURFACE MATERIAL
Yu. A. Surkov, G. A. Fedoseyev, O. P. Sobornov, G. B. Nazarkina, and L. P. Bachina *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 311-319 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 370-378 (For availability see N75-11814 02-91)
CSCL 03B

Using a scintillation gamma spectrometer with shielding against anticoincidences, the content of the natural radioelements (K, U, and Th) and long-lived cosmogenic radioisotopes (Al-26, Na-22, and Mn-54) in a sample of Sea of Fertility regolith was determined. Based on the content data of natural radioelements, an attempt was made to classify this sample in the scale of petrochemical types of terrestrial rocks arranged in accordance with their silicic content and alkalinity. Within the frame of reference of calcium-uranium systematics of lunar samples, a comparison was made of the K/U ratio obtained for the Sea of Fertility sample with analogous data for other regions of the moon. Also discussed are problems on the depthwise distribution of cosmogenic radioisotopes along the regolith profile. Author

N75-11853* Kanner (Leo) Associates, Redwood City, Calif.
SOME RESULTS OF TRACK METHOD OF INVESTIGATING LUNA 16 LUNAR MATERIAL
L. L. Kashkarov, A. K. Lavrukhina, and L. I. Genayeva *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 379-387 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 421-429 (For availability see N75-11814 02-91)
CSCL 03B

Preliminary data from an investigation of tracks in olivine crystals, separated from the five zones of a lunar surface material core, are reported. The gradients of track densities, their lengths, and their angular distribution were measured with an optical microscope. Throughout the core depth (35 cm) crystals bearing traces of exposure to low energy solar cosmic rays were found, indicating the occurrence of mixing processes in the surficial layer of lunar surface material. The age of the occurrence of the samples investigated on the lunar surface, calculated from the track density, is in the interval 0.7 to 16 million years.
Author

N75-11854* Kanner (Leo) Associates, Redwood City, Calif.
RADIATION DAMAGE AND STRUCTURE RECORDED AT HIGH RESOLUTION IN GRAINS FROM FINE FRACTIONS OF LUNA 16 SURFACE MATERIAL
L. Durrieu, C. Jouret, J. P. Bibring, R. Meunier, and M. Maurette *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 388-399 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 430-435 (For availability see N75-11814 02-91)
CSCL 03B

Samples returned to earth by Luna 16, were studied with a high voltage electron microscope for ultramicroscopic features. The following amazing features were noted in particles of surface material returned in all the lunar trips: A very high density of tracks of nuclear particles, ultrathin amorphous shells, highly rounded forms, and amazingly good ordering of crystal lattice. These features were used along with calibration experiments in solving the following problems: (1) determining the energy spectrum and chemical abundances of the very heavy nuclei in the solar wind and in the solar cosmic rays; (2) studying the past activity of the sun; (3) obtaining data on lunar dynamic processes affecting dust particles; (4) analyzing composite effects caused by penetration of solar wind into the lunar surface material; and (5) establishing the existence of the ancient lunar atmosphere and magnetic field. Author

N75-11855* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF SAMPLE OF SEA OF FERTILITY LUNAR SURFACE MATERIAL BY THE TRACK METHOD
G. Poupeau, G. C. Chatrit, and P. Pellas *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 400-403 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 436-443 (For availability see N75-11814 02-91)
CSCL 03B

Tracks in crystals of feldspars, olivines, pyroxenes, and in several fragments of basalts from a sample of Luna 16 lunar surface material were studied. A high track density, exceeding 10 to the 8th power cm/2 was found. The tracks were produced mainly by iron group nuclei of cosmic galactic and solar rays. Author

N75-11856* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF RADIATION DAMAGE AND STRUCTURE OF LUNA 16 SAMPLE PARTICLES USING HIGH-RESOLUTION ELECTRON MICROSCOPES
J. Borg, D. Durrieu, C. Jouret, L. L. Kashkarov, M. Maurette, and P. Moris *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 404-409 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 444-454 (For availability see N75-11814 02-91)
CSCL 03B

Using an electron scanning microscope and a high voltage microscope, a study was made of the radiation damage and structure of micron sized grains and grains separated from the 200-mesh fraction of the L-16-19 surface material sample. Then the structural features were compared with those found by studying with the same techniques grains separated from 20 different samples of lunar dust taken from the Apollo 11, Apollo 12, Apollo 14, and Apollo 15 collections. The L-16-19 sample is similar to the most intensely irradiated samples returned to earth by Apollo craft. Author

N75-11857* Kanner (Leo) Associates, Redwood City, Calif.
ABSOLUTE AGE OF LUNAR REGOLITH MATERIAL FROM THE SEA OF FERTILITY
A. P. Vinogradov and Yu. M. Artemov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 410-435 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 455-467 (For availability see N75-11814 02-91)
CSCL 03B

By averaging the absolute age of lunar regolith materials from the Sea of Fertility for the fine regolith fraction from the core zone V, an age of 4.65 10 to the 9th power + 0.4 10 to the 9th power years was obtained, employing as the primordial Sr-87/Sr-86 ratio 0.69884 (ADOR). Also close to this age value is the age estimate based on the Pb-207/Pb-206 ratio. Using the value 0.69898 (BABI) as a primordial Sr-87/Sr-86 ratio reduces the calculated age of the fine regolith fraction to 4.25 X 10 to the 9th power years. The fine fraction of lunar regolith from the Sea of Fertility is also characterized by a minimum addition of radiogenic Sr-87, a minimum Rb/Sr ratio, and a maximum K/Rb ratio compared with analogous lunar material from other points. Author

N75-11858* Kanner (Leo) Associates, Redwood City, Calif.
Rb-Sr AGE AND CONTENT OF POTASSIUM, RUBIDIUM STRONTIUM, BARIUM, AND RARE EARTHS IN SURFACE MATERIAL FROM THE SEA OF FERTILITY
C. J. Allegre, J. L. Birck, M. Loubet, and A. Provost *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 436-440 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 468-495 (For availability see N75-11814 02-91)
CSCL 03B

The Luna 16 automatic station returned from the Sea of Fertility a 35 cm long column of lunar surface material. 1 g of the Luna 16 lunar surface material, taken at a depth of 22 cm, consists of fine material: surface material and fine fragments of rocks from 1 to 4 mm in diameter. Analyses made on 17 mg of the fine lunar surface material are presented. The results obtained for the Luna 16 surface material are plotted on the diagram of the isotopic evolution of strontium and show that this surface material is most depleted of radiogenic Sr-87 of all the known lunar surface materials and that the point characterizing Lunar 16 lies somewhat to the right of the line corresponding to an age of 4.6 billion years. Author

N75-11859* Kanner (Leo) Associates, Redwood City, Calif.
OPTICAL CHARACTERISTICS OF REGLOITH FROM THE SEA OF FERTILITY, SEA OF TRANQUILLITY, AND OCEAN OF STORMS
I. I. Antipova-Karatayeva, Yu. I. Stakheyev, and K. P. Florenskiy *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 441-448 refs Transl. into ENGLISH from the Book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 496-500 (For availability see N75-11814 02-91)
CSCL 03B

A diffuse reflection spectra analysis is reported for regolith returned by the Luna 16 automatic station and by the Apollo 11 and Apollo 12 expeditions. The spectra of the specular reflection of Sea of Fertility regolith, as well as the spectra of diffuse reflection from polished sections of lunar rocks from the Sea of Tranquillity and the Ocean of Storms have no well-defined structures and are close to each other. The lowest reflectivity is exhibited by the Sea of Tranquillity regolith, and the highest -- by the Ocean of Storms regolith. A weak absorption band with a maximum near 1 nm is noted in the spectra, corresponding to the Fe-2(+) ion in the octahedral position in the lattice of regolith mineral constituents. When the indicatrix of scattering of the regolith was recorded, a specular component was detected. Author

N75-11860* Kanner (Leo) Associates, Redwood City, Calif.
LIGHT SCATTERING INDICATRICES OF LUNAR SURFACE MATERIAL RETURNED BY LUNA 16 AUTOMATIC STATION
N. P. Barabashov and L. A. Akimov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 449-452 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 501-502 (For availability see N75-11814 02-91)
CSCL 03B

Measurements are made of the indicatrix of scattering of lunar surface material with an indicatometer that has a spread of the illuminating beam of less than 0.5 deg and of the detected beam of about 1.5 deg. The results are compared with the indicatrices for the lunar mean obtained by terrestrial telescopic measurements. It is concluded that the main features of the reflection of light by the moon) (rapid rise in brightness with approach to the full moon) are accounted for by the microrelief caused principally by grains smaller than a millimeter. Author

N75-11861* Kanner (Leo) Associates, Redwood City, Calif.
INFRARED SPECTROSCOPY OF LUNAR MARE REGOLITH
M. V. Akhmanova, B. V. Dementyev, A. V. Kartashev, A. V. Karyakin, M. N. Markov, and M. M. Sushchinskiy *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 453-467 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 503-511 (For availability see N75-11814 02-91)
CSCL 03B

Spectra of reflection, emission, and transmission of regolith returned by the Luna 16 automatic station were investigated in the 1.8-13 micrometers region. A reflection maximum was shown to be present in the region 3 to 5 micrometer, along with a corresponding minimum in the emission coefficient. The spectra were interpreted based on a comparison of the optical properties with the chemical and structural properties of the regolith. The regolith in the entire array of properties in the infrared region differs appreciably from terrestrial objects. Spectra of diffuse reflection and the spectra at angles of incidence 0 deg and angles of reflection 15 and 30 deg with samples of the regolith returned by the Apollo 11 and Apollo 12 missions revealed a similarity of the infrared reflection characteristics of the regolith from different lunar mare regions. Author

N75-11862* Kanner (Leo) Associates, Redwood City, Calif.
PHOTOMETRIC AND POLARIMETRIC ANALYSIS OF SAMPLES OF LUNAR SURFACE MATERIAL RETURNED BY THE LUNA 16 AUTOMATIC STATION
A. Dollfus and E. Bowell *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 468-476 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 512-516 (For availability see N75-11814 02-91)
CSCL 03B

Polarimetric properties were determined for the L-16-19-1-116 samples, weighing 0.087 g. The measurements were made for five wavelengths between 3540 and 5850 AU. In addition, the normal albedo was determined for each of these wavelengths. The albedo for the measured sample was slightly lower than for the typical material of the dark lunar maria and in addition, there was a well developed branch of negative polarization, which resembles the branch obtained for carbonaceous chondrites crushed into powder, and the branch obtained for the powders of several terrestrial basaltic and ultrabasic rocks. Author

N75-11863* Kanner (Leo) Associates, Redwood City, Calif.
PHOTO-POLARIZATION STUDY OF LUNAR SAMPLES: NEGATIVE BRANCH
A. Dollfus and E. Bowell *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 477-485 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 517-523 (For availability see N75-11814 02-91)
CSCL 03B

Polarization measurements with a telescope for the degree of polarization of light reflected by planetary surfaces, and comparative measurement of terrestrial minerals, meteorites, and returned lunar samples are reported. The polarization curve plots of the dependence of the degree of polarization on the phase angle V are plotted and compared with each other to determine the optical characteristics of the planetary surfaces. Author

N75-11864* Kanner (Leo) Associates, Redwood City, Calif.
INFRARED TRANSMISSION SPECTRA OF SEA OF FERTILITY REGOLITH
M. V. Akhmanova, A. V. Karyakin, and L. S. Tartasov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 486-495 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 524-528 (For availability see N75-11814 02-91)
CSCL 03B

Transmission spectra in the 2-25 micrometer region were obtained for samples of lunar regolith returned by the Luna 16 automatic station. A comparison of the Luna 16, Apollo 11, and Apollo 12 samples showed that the infrared transmission spectra of regolith samples from the mare regions are similar and characteristic of basic basaltic rocks. The absorption bands show up in the vibration region of the SiO4 groups. No water and OH groups were found in the samples based on the spectrum. Spectra of regolith samples calcined at 1000C showed changes that can be interpreted as changes in the spectra of irradiated crystals (especially distinctly for the Luna 16 samples). Author

N75-11865* Kanner (Leo) Associates, Redwood City, Calif.
CATHODOLUMINESCENCE OF REGOLITH RETURNED BY LUNA 16 AUTOMATIC STATION
G. V. Spivak, M. K. Antoshin, N. P. Ilin, and G. V. Saparin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 496-501 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 529-531 Original contains color illustrations (For availability see N75-11814 02-91)
CSCL 03B

Observations of local variations in the intensity and spectral composition of the cathodoluminescence of lunar regolith are described. These variations are caused by structural features, by the kind and quantity of the material, and by the admixtures. In addition, cathodoluminescent emission is also associated with a change in the temperature of the lunar surface. Periodic diurnal illumination and darkening of the moon is responsible for a temperature gradient normal to the lines of longitude. These observations made of regolith, using a scanning electron microscope with an attachment for temperature variation, simulate the indicated thermal changes of the cathodoluminescent properties of lunar material. Author

N75-11866* Kanner (Leo) Associates, Redwood City, Calif.
MAGNETIC PROPERTIES OF LUNAR SAMPLES RETURNED BY LUNA 16 AUTOMATIC STATION
E. S. Gorshkov, Ye. G. Guskova, and V. I. Pochtarev *In its*

Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 502-511 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 532-537 (For availability see N75-11814 02-91)
CSCL 03B

Results of measuring the specific magnetic susceptibility of regolith are presented. The data indicate that regolith samples from the Sea of Tranquillity and the Sea of Fertility are similar in order of magnitude of the specific magnetic susceptibility. Several stony meteorites of subgroup L have a similar value of this quantity. After comparison with artificial analogs, it can be concluded that the bulk content of ferromagnetic minerals in regolith samples is 3 to 4 percent. Author

N75-11867* Kanner (Leo) Associates, Redwood City, Calif.
METALLOGRAPHIC STUDY OF METALLIC FRAGMENT OF LUNAR SURFACE MATERIAL
R. I. Mints, T. M. Petukhova, and A. V. Ivanov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 512-520 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 538-542 (For availability see N75-11814 02-91)
CSCL 03B

A high precision investigation of a metallic fragment from the lunar material returned by the Soviet Luna 16 automatic station revealed three characteristic temperature intervals with different kinetics of solid solution decomposition. The following were found in the structure of the iron-nickel-cobalt alloy: (1) delta-phase and alpha-ferrite of diffusional, displacement origin in the grain boundary and acicular forms; and (2) martensite of isothermal and athermal nature, acicular, lamellar, massive, and dendritic. The diversity of the shapes of structural constituents is associated with the effect on their formation of elastic distortions and various mechanisms of deformation relaxation processes. Author

N75-11868* Kanner (Leo) Associates, Redwood City, Calif.
EXOELECTRONIC EMISSION OF PARTICLES OF LUNAR SURFACE MATERIAL
R. I. Mints, V. I. Alimov, V. P. Melekhin, I. I. Milman, V. I. Kryuk, L. L. Kunin, and L. S. Tarasov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 521-527 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 543-546 (For availability see N75-11814 02-91)
CSCL 03B

A secondary electron multiplier was used to study the thermostimulated exoelectronic emission of particles of lunar surface material returned by the Soviet Luna 16 automatic station. The natural exoemission from fragments of slag, glass, anorthosite, and a metallic particle was recorded in the isochronic and isothermal thermostimulation regimes. The temperature of emission onset depended on the type of regolith fragment. For the first three particles the isothermal drop in emission is described by first-order kinetic equations. For the anorthosite fragment, exoemission at constant temperature is characterized by a symmetric curve with a maximum. These data indicate the presence of active surface defects, whose nature can be due to the prehistory of the particles. Author

N75-11869* Kanner (Leo) Associates, Redwood City, Calif.
TEMPERATURE EMISSION SPECTRUM OF EXOELECTRONS OF LUNAR REGOLITH
R. I. Mints, V. I. Alimov, V. P. Melekhin, I. I. Milman, V. I. Kryuk, T. M. Petukhova, L. L. Kunin, and L. S. Tarasov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 528-537 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 547-552 (For availability see N75-11814 02-91)
CSCL 03B

Thermostimulated exoelectronic emission of eight fragments of regolith returned by the Soviet Luna 16 automatic station was studied. The nature of the exoemission glove-curves was determined by particle type. Fragments of breccia, sinter, slag, anorthosite, glass plate, and leucocratic gabbro after the first heating disclosed a single exoemission maximum, whose temperature position is in the range 115 to 200 C. The data obtained indicate the complex and inhomogeneous energy structure of some regolith fragments. The presence of surface states capable of forming sorptive bonds can be assumed for most particles. The exoemission of anorthosite, olivine, and the glass spherule is due to the presence of formation defects at their surfaces. Author

N75-11870* Kanner (Leo) Associates, Redwood City, Calif.
HEAT-PHYSICAL PROPERTIES OF LUNAR SURFACE MATERIAL RETURNED TO EARTH BY THE LUNA 16 AUTOMATIC STATION
V. S. Avduyevskiy, N. A. Anfimov, M. Ya. Marov, Yu. A. Treskin, S. P. Shalayev, and A. P. Ekonomov *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F15881) Oct. 1974 p 538-548 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 553-558 (For availability see N75-11814 02-91)
CSCL 03B

Density, specific heat capacity, and coefficient of thermal conductivity were studied on a sample of lunar surface material returned by the Luna 16 automatic station. The study was carried out in a helium-filled chamber. The density of the surface material when freely heaped was 1.2 g/cu cm, and when shaken down -- 1.7 g/cu cm. The specific heat capacity was 0.177 + or - 0.010 cal x g/1 x deg/1. The coefficient of thermal conductivity in the material was 4.8 x 10/6 + or - 1.2 x 10/6 cal x cm/1 x sec/1 x deg/1. Author

N75-11871* Kanner (Leo) Associates, Redwood City, Calif.
RESULTS OF INVESTIGATING THERMAL AND ELECTRICAL PROPERTIES OF LUNAR SURFACE MATERIAL AND ITS ANALOGS
A. R. Golovkin, Ye. A. Dukhovskoy, G. Ya. Novik, R. G. Petrochenkov, V. V. Rzhevskiy, A. A. Silin, and V. V. Shvarev *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 549-555 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 559-562 (For availability see N75-11814 02-91)
CSCL 03B

Thermal and electrical properties are reported of lunar surface material returned to Earth by the Luna 16 automatic station and its terrestrial analogs studied in a vacuum and in a helium atmosphere. Study of the lunar surface material and its analogs showed that their specific heat capacity and electrical properties are similar in value but the coefficients of thermal conductivity differ. The results are compared with data on thermal and electrical properties of the surficial layer of the Moon obtained by indirect radiometric methods, and with results obtained for samples of lunar surface material returned to Earth by the crew of the Apollo 11 spacecraft. Author

N75-11872* Kanner (Leo) Associates, Redwood City, Calif.
RESULTS OF INVESTIGATING THE PHYSICOMECHANICAL PROPERTIES OF A SAMPLE OF LUNAR SURFACE MATERIAL IN A RESEARCH CHAMBER IN NITROGEN
A. K. Leonovich, V. V. Gromov, A. N. Dmitriyev, V. A. Lozhkin, P. S. Pavlov, A. V. Rybakov, and V. V. Shvarev *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 556-569 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 563-570 (For availability see N75-11814 02-91)
CSCL 03B

Results are reported on an investigation of the mechanical properties of the lunar surface material sample returned by the Luna 16 automatic station. The study included determination of the specific weight of the surface material, the nature of its disintegration, and the determination of its compressibility characteristics, shear resistance, and bearing capacity. Quantitative data are presented on mechanical properties for the lunar surface material, many of which are determined for the first time. The instruments and experimental techniques are described. Author

N75-11873* Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF MECHANICAL PROPERTIES OF LUNAR SURFACE MATERIAL AND ITS ANALOGS IN DIFFERENT ATMOSPHERIC CONDITIONS AND IN VACUUM ON THE TOR-1 UNIT
A. I. Vedenin, Ye. A. Dukhovskoy, V. V. Markachev, A. A. Silin,

I. I. Cherkasov, and V. V. Shvarev *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 570-589 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 571-581 (For availability see N75-11814 02-91)
CSCL 03B

The design of measuring assemblies in the TOR-1 instrument is presented along with methods for determining the specific resistance to penetration, compressibility, and the resistance to rotational shearing of lunar surface material and its analogs. Investigations were conducted in helium at normal pressure, as well as in vacuum in the temperature range + (20-140) C. Values of the specific resistance to penetration of the lunar surface material, coefficients of relative compressibility, and the parameters of the resistance to rotational shearing were obtained for three kinds of compaction of the lunar surface material. Author

N75-11874* Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF FRICTION PROPERTIES OF LUNAR SURFACE MATERIAL AND ITS ANALOGS
Ye. A. Dukhovskoy, E. A. Motovilov, A. A. Silin, M. I. Smorodinov, and V. V. Shvarev *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 590-596 Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 582-586 (For availability see N75-11814 02-91)
CSCL 03B

A description is given of instruments for determining the friction properties of the surficial layer of lunar surface material returned by the Luna 16 automatic lunar station, as well as the friction properties of its analogs: andesite-basaltic sand and basalts. The experimental method and results are presented.
Author

N75-11875* Kanner (Leo) Associates, Redwood City, Calif.
MICROBIOLOGICAL AND EXPERIMENTAL-HISTOLOGICAL INVESTIGATIONS OF LUNAR SAMPLES RETURNED BY THE LUNAR 16 AUTOMATIC STATION
D. R. Kaulen, T. I. Bulatova, A. Ya. Fridenshteyn, and Ye. B. Skvortsova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 597-605 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 587-591 (For availability see N75-11814 02-91)
CSCL 03B

Lunar surface material was studied for its content of viable microorganisms (aerobic and anaerobic, fungi, and viruses); the effect of the lunar surface material on the growth of microorganisms and its interaction with somatic cells of mammals was also observed. No viable microorganisms were detected; the samples exhibited neither stimulant or inhibitory action on the growth of microorganisms, and also showed no cytopathogenic action on tissue cultures. A suspension of lunar surface material particles was not toxic when parenterally administered to certain laboratory animals. The particles were subjected to intense phagocytosis by connective tissue cells in vivo and in vitro.
Author

N75-11876* Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF BIOLOGICAL ACTIVITY OF FINE FRACTION OF LUNAR SURFACE MATERIAL RETURNED TO EARTH BY THE LUNA 16 AUTOMATIC STATION
V. V. Kustov, O. F. Ostapenko, and V. G. Petrukhin *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 606-612 refs Transl. into English from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 592-595 (For availability see N75-11814 02-91)
CSCL 03B

The biological action of a sample of lunar surface material returned to earth by the Luna 16 automatic station from a new region of the mare surface on male white mice was studied. The condition and behavior of the animals were observed; the intensity of their oxygen consumption was recorded, and motor activity of the muscles, leucocyte and erythrocytes counts in the peripheral blood, and the activity of whole blood chloinesterase were determined. Experimental results showed that the tested doses of the fine fraction of the lunar surface material from the Sea of Fertility were virtually innucuous for white mice. Author

N75-11877* Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF LUNAR SURFACE MATERIAL ON RADIATION DAMAGE IN MICE (INVESTIGATION OF BIOLOGICAL ACTION OF LUNAR SURFACE MATERIAL RETURNED TO EARTH BY LUNA 16 AUTOMATIC STATION) c51
V. V. Antipov, B. I. Davydov, N. A. Gaydamakin, T. S. Lvova, V. G. Petrukhin, S. N. Komarova, and Ye. B. Skvortsova *In its* Lunar Soil from the Sea of Fertility (NASA-TT-F-15881) Oct. 1974 p 613-626 refs Transl. into ENGLISH from the book "Lunnyy Grunt iz Morya Izobiliya" Moscow, Nauka Press, 1974 p 596-604 (For availability see N75-11814 02-91)
CSCL 06C

The effect was studied of lunar surface material from the Sea of Fertility on the radiation reaction (damage) in mice caused by exposure to ionizing radiation. The material was administered to the organism in three ways -- aerogenically, through the esophagus, or peritoneally. It was shown that administering the lunar surface material did not appreciably affect the death of the animals and the reaction of the peripheral blood caused by the action of radiation. In mice which prior to irradiation had been administered inhalationally or peritoneally the lunar surface material, a lag in the increment of bodyweight was observed.
Author

N75-11878*# Lunar Science Inst., Houston, Tex.
SHORT GUIDE TO LUNAR SAMPLE INFORMATION
Charles H. Simonds, Jody H. Heiken, and Frances B. Waranius Nov. 1974 14 p refs
(Contract NSR-09-051-001)
(NASA-CR-140814; LSI-Contrib-200) Avail: NTIS HC $3.25 CSCL 03B

Data pertaining to the collection, processing, and study of lunar samples, and the ways to gain access to that data are described. Data pertaining to the samples includes not only the normally published literature but also NASA and USGS interagency documents, sample processing information, and photography taken from lunar orbit, on the lunar surface, and of samples in the Lunar Receiving Laboratory.
Author

N75-11879*# Howard Univ., Washington, D.C. Dept. of Physics.
OPTICAL MAGNETIC, AND ELECTRICAL PROPERTIES OF TEKTITES, METEORITES, AND OTHER SPACE RELATED MATERIALS Final Report
Sep. 1974 9 p refs
(Grant NGL-09-011-006)
(NASA-CR-140744) Avail: NTIS HC $3.25 CSCL 03B

The scope of the project is reported to study the infrared absorption of water and the magnetic properties of the iron in tektites. Subsequently, the work was expanded to include the other properties of tektites and lunar materials. When the lunar samples became available, the emphasis of the research shifted from tektites to lunar samples.
M.C.F.

N75-11880*# Michigan Univ., Ann Arbor. Dept. of Geology and Mineralogy.
STUDIES OF MARTIAN POLAR REGIONS Final Report
Charles I. Smith, Bruce R. Clark, and Donald F. Eschman [1974] 35 p refs
(Grant NGR-23-005-563)
(NASA-CR-140819) Avail: NTIS HC $3.75 CSCL 03B

The flow law determined experimentally for solid CO2 establishes that an hypothesis of glacial flow of CO2 at the Martian poles is not physically unrealistic. Compression experiments carried out under 1 atmosphere pressure and constant strain rate conditions demonstrate that the strength of CO2 near its sublimation point is considerably less than the strength of water ice near its melting point. A plausible glacial model for the Martian polar caps was constructed. The CO2 deposited near the pole would have flowed outward laterally to relieve high internal shear stresses. The topography of the polar caps, and the uniform layering and general extent of the layered deposits were explained using this model.
Author

N75-11881# Brookhaven National Lab., Upton, N.Y.
RADIOACTIVE RARE GASES AND TRITIUM IN THE SAMPLE RETURN CONTAINER, AND THE Ar-37, Ar-39, TRITIUM, HYDROGEN, AND HELIUM DEPTH PROFILES

IN THE APOLLO 16 AND 17 DRILL STEMS
R. W. Stoenner, R. Davis, Jr., E. Norton, and M. Bauer 1974 39 p refs Presented at 5th Lunar Sci. Conf., Houston, Tex., 18 Mar. 1974 Sponsored by AEC
(BNL-18808; Conf-740321-1) Avail: NTIS HC $3.75

The gas was extracted from the sample return container from the Apollo 16 and Apollo 17 missions by adsorption on charcoal and activated vanadium metal. The hydrogen, argon, and radon were separated and counted to give the tritium, Ar-37, Ar-39, and Rn-222 activities. The tritium and argon activities observed are explained by diffusive losses of these gases from the fine material in the container. There was no excess tritium present in the Apollo 17 containers that are attributable to solar tritons remaining from the intense flare of August 4, 1972. The Rn-222 observed in the sample return container was interpreted as an emanation product from lunar fines, and an emanation yield of 0.0001 was calculated. This yield is consistent with the low radon content observed in the lunar atmosphere.
Author (NSA)

N75-11882# Army Construction Engineering Research Lab., Champaign, Ill.
EVALUATION OF LUNAR DRILLING TECHNOLOGY FOR TERRESTRIAL APPLICATIONS Final Report
R. E. Aufmuth Jul. 1974 20 p
(DA Proj. 4A1-62121-A-890)
(AD-782914; CERL-TR-M-96) Avail: NTIS CSCL 13/9

This report presents results of a laboratory evaluation of a NASA developed drill system for obtaining test core samples of concrete, rock, and soil materials for nondestructive testing. Excellent test cores from a variety of materials were obtained at drilling rates greater than normally achieved with conventional systems. Additional tests are required to asses the cost effectiveness of the system. Author (GRA)

N75-10989* Kanner (Leo) Associates, Redwood City, Calif.
DETERMINATION OF THE LANDING POINT AND ORIENTATION OF A SPACECRAFT ON MARS
G. A. Mersov *In its* Equipment for Space Res. (NASA-TT-F-785) Oct. 1974 p 1-22 refs Transl. into ENGLISH from the book "Apparatura dlya Kosmicheskikh Issledovaniy" Moscow, Nauka Press, 1972 p 3-15 (For availability see N75-10988 02-18) CSCL 22A

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N75-11883# Joint Publications Research Service, Arlington, Va.
SOLAR NEUTRINOS
B. Ye. Yavelov 30 Oct. 1974 18 p refs Transl. into ENGLISH from Priroda (USSR), no. 7, 1974 p 46-53
(JPRS-63323) Avail: NTIS HC $3.25

The source of the sun's energy is discussed and the Davis neutrino detector is described. Neutrinos and the nature of the center of the sun are discussed. Author

N75-11884# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-TERRESTRIAL PHYSICS SERVICES AND PUBLICATIONS
Oct. 1974 29 p refs
Avail: NTIS HC $3.75

A detailed list of solar-terrestrial physics data categories is provided, along with pertinent subdisciplines, in order to specify the nature of the data dissemination services and publications sponsored by NOAA. Price lists and subscription information are included with each description of particular films, reports, compilations, microfilm data, digitalized tabular data, magnetic tapes, and other special publications and services offered for general use by NOAA. A.A.D.

N75-11885*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR PARTICLE EVENTS WITH ANOMALOUSLY LARGE RELATIVE ABUNDANCE OF He-3
A. T. Serlemitsos (Computer Sci. Corp., Silver Spring, Md.) and V. K. Balasubrahmanyan Oct. 1974 27 p refs Submitted for publication
(NASA-TM-X-70780; X-661-74-312) Avail: NTIS HC $3.75 CSCL 03B

Experimental results are reported on three energetic particle events with extremely high abundance of He-3. The measurements were taken onboard the OGO-5 satellite. It was shown that the abundance of protons relative to He nuclei were significantly low in these events. Not more than four H-2 and three H-3 were detected during the entire period under study compared to 1110 H-3 nuclei. The limitations these observations place on theoretical models are discussed to explain He-3 flares. M.C.F.

N75-11886# Sandia Labs., Albuquerque, N.Mex. Photometrics Div.
PHOTOGRAPHIC TECHNIQUE TO DETERMINE THE APPARENT ENERGY DISTRIBUTION OF THE SOLAR AUREOLE
C. E. Robertson and J. H. Banker Mar. 1974 11 p
(Contract AT(29-1)-789)
(SLA-74-90) Avail: NTIS HC $3.25

Photographic film, after processing, forms silver in proportion to the amount of solar energy which falls upon the film during exposure. The relationship between the amount of solar energy and the amount of silver is determined through sensitometry.
Author (NSA)

N75-11887# Boston Univ., Mass. Dept. of Astronomy.
SOLAR AND GEOPHYSICAL RADIO OBSERVATIONS. 1: POLARIZATION OBSERVATIONS OF SOLAR ACTIVE REGIONS. 2: SUGGESTIVE EVIDENCE OF TILTED IONOSPHERIC TROUGHS
Michael D. Papagiannis Dec. 1973 37 p refs Presented at the 141st Amer. Astron. Soc. Meeting, Tucson, Ariz., Dec. 1973, and the 55th Ann. Meeting of the Amer. Geophys. Union, Washington, D. C., Apr. 1974
(Contract F19628-73-C-0058; AF Proj. 4643)
(AD-784864; SER-2-No-58; AFCRL-TR-74-0348; SR-1) Avail: NTIS CSCL 03/2

Disturbed conditions of the terrestrial atmosphere, ionosphere, and magnetosphere, and their dependence on solar activity are studied. Report covers polarization observations of solar active regions and total electron content studies with emphasis on ionospheric trough effects. Extensive observations of left and right circular polarized emission at 7.875GHz from solar active regions were made. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N75-11888*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF COSMIC GAMMA-RAY BURSTS WITH IMP-7: EVIDENCE FOR A SINGLE SPECTRUM
T. L. Cline and U. D. Desai Sep. 1974 14 p refs Submitted for publication
(NASA-TM-X-70778; X-661-74-296) Avail: NTIS HC $3.25 CSCL 03B

Spectral observation of nine recent cosmic gamma-ray bursts are reported. The average photon number spectra of all nine events are shown to be consistent with a 150-keV exponential from 100 keV to about 400 keV, and a power law of index -2.5 from 400 keV to 1100 keV. The observations also indicate an event rate of 16 in 1972 and 1973, or 8 + or - 2 per year, higher than the 5 + or - 1 per year initially reported. This corresponds to an approximately 40-percent lower effective intensity threshold, attained by using more sensitive detectors in multiple-satellite coincidence. Author

N75-11889*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DIRECTION FINDING MEASUREMENTS OF AURORAL KILOMETRIC RADIATION
William S. Kurth, Mark M. Baumback, and Donald A. Gurnett Oct. 1974 37 p refs
(Contracts NAS1-11257; NAS1-13129; NAS5-11431; Grant NGL-16-001-043; Contract N00014-68-A-0196-0009)
(NASA-CR-140766; U-OF-IOWA-74-35) Avail: NTIS HC $3.75 CSCL 03B

Direction finding measurements with plasma wave experiments onboard the Hawkeye-1 and IMP-8 satellites were used to locate the source region of auroral kilometric radiation. The radiation exhibits peak intensities between about 100 kHz and 300 kHz, and emits intense sporadic bursts lasting for between one half hour to several hours. The total power emitted in this frequency range exceeds 10 to the 9th power watts at peak intensity. The occurrence of the radiation is known to be closely associated with bright auroral arcs which occur in the local evening auroral regions. Author

N75-11890# Denver Univ., Colo.
THE 13TH INTERNATIONAL COSMIC RAY CONFERENCE. VOLUME 1: OG SESSIONS
1973 747 p refs Conf. held at Denver, 17 - 30 Aug. 1973 Sponsored by AEC
(Conf-730804-P1-Vol-1) Avail: NTIS HC $17.25

Origin and galactic phenomena including particles and photon spectra are reported. Abstracts are presented for the 112 complete papers in this volume. M.C.F.

N75-11891# Commissariat a l'Energie Atomique, Saclay (France).
MONTE CARLO COMPUTATION FOR ISOTOPIC ANALYSIS OF COSMIC RAYS BY MEANS OF THE EARTH MAGNETIC FIELD
P. Hubert Apr. 1974 19 p In FRENCH
(CEA-R-4559) Avail: AEC Depository Libraries HC $4.00

Filtering of charged cosmic rays arriving through the geomagnetic field is evaluated from the results of numerical integration performed on a large number of randomly selected trajectories. The random procedure follows a consequence of Liouville theorem. It takes into account the shape of the external spectrum and the geometrical conditions of the experiment. After rejecting the forbidden trajectories, it is possible to predict the shape of an experimental spectrum if the response curve and the dispersion of the detector are known. The isotopic composition can then be deduced from a comparison between computed and measured spectra. The time required for a given precision is computed as an example, in the case of a possible experiment. Author (NSA)

99 GENERAL

No abstracts in this category.

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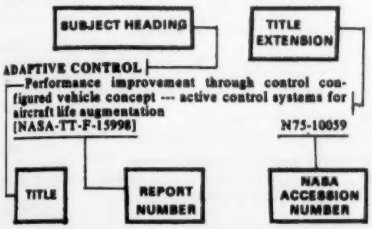

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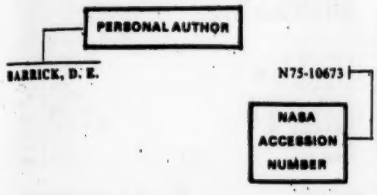

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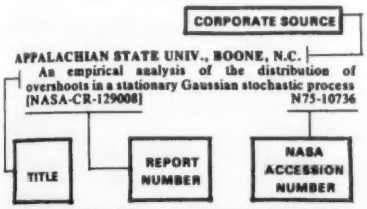
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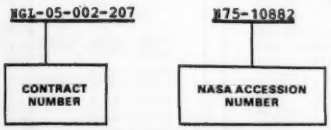

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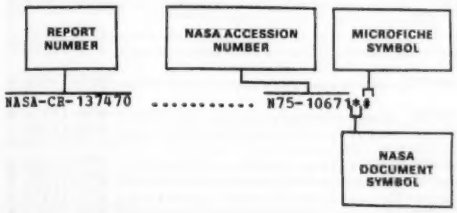

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